January 14, 2005

Errata Sheet for

Data Quality Assessment Report for the Post-Decontamination Characterization of the Contents of Tank WM-183 at the Idaho Nuclear Technology and Engineering Center Tank Farm Facility, INEEL/EXT-03-01202 revision 1

Errata No. 1:

Table 25. The 95% UCL for ^{99}Tc should be 1.75E+03 pCi/L rather than 1.68 E+03 pCi/L.

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ABSTRACT

This report documents the assessment of the data collected during the cleaning of Tank WM-183 at the Idaho National Engineering and Environmental Laboratory Idaho Nuclear Technology and Engineering Center Tank Farm Facility. The data assessed in this report were generated from the sample analysis of residual tank liquids remaining after decontamination. Because decontamination activities reduced the volume of solids remaining in the tank to less than 15% by volume of the total sample collected, the solids portion of the samples collected were not analyzed and compared with the action levels for regulated constituents. Data from the sample analysis of the liquids from the tank vault sumps or diversion valve boxes are not analyzed in this document but will be addressed in a subsequent report. The residual tank liquids data were assessed to determine whether the concentrations of regulated constituents were reduced below the action levels necessary for clean closure. Radionuclide data were compared with an established inventory. The analysis shows all radionuclide activities are less than the inventory values modeled in the tank performance assessment. The analysis also shows that clean closure action levels were achieved for the chemical constituents in the tank. Based on the data analysis, decisions associated with these data can be made with a high degree of confidence.

FOREWORD

Tank WM-183 is one of 15 tanks at the Idaho National Engineering and Environmental Laboratory Idaho Nuclear Technology and Engineering Center Tank Farm Facility. The cleaning of Tank WM-183 was performed as part of the Resource Conservation and Recovery Act (RCRA) clean closure and Department of Energy (DOE) high-level waste tank closure activities underway at the Idaho Nuclear Technology and Engineering Center Tank Farm Facility. The data were compared to three criteria:

- For RCRA clean closure, the data were assessed to determine whether the concentrations of RCRA-regulated constituents were reduced to levels below the action levels specified for clean closure in *Idaho Hazardous Waste Management Act/Resource Conservation and Recovery Act Closure Plan for Idaho Nuclear Technology and Engineering Center Tanks WM-182 and WM-183* (DOE-ID 2003a). This analysis indicates clean closure action levels were not exceeded by liquid contaminants in Tank WM-183. Because decontamination activities reduced the volume of solids remaining in the tank to less than 15% by volume of the total sample collected, the solids portion of the samples collected were not analyzed and compared with the action levels for regulated constituents.

- For DOE high-level waste tank closure, the radionuclide data were compared with the radionuclide concentrations that were used in the *Performance Assessment for the Tank Farm Facility at the Idaho National Engineering and Environmental Laboratory* (DOE-ID 2003b). These values were based on sampling data and predicted values from the ORIGEN numerical model. This model is used to predict the radionuclides and relative values in waste streams. An inventory of radionuclides that remains in the tanks after decontamination was prepared for the performance assessment and is used in this document as an indicator of compliance with DOE radionuclide performance objectives.

- The data collected from sampling the post-decontamination, residual, liquid contents of Tank WM-183 were assessed against the criteria for data quality specified in the *Sampling and Analysis Plan for the Post-Decontamination Characterization of the WM-182 and WM-183 Tank Residuals* (INEEL 2002).

CONTENTS

TABLES

ACRONYMS

AL	action level
CAS	Chemical Abstract Service
CFR	Code of Federal Regulations
CV	coefficient of variation
df	degrees of freedom
DQA	data quality assessment
DQO	data quality objective
DOE	Department of Energy
HWMA	Hazardous Waste Management Act
ICP-MS	inductively coupled plasma-mass spectrometry
LCL	lower confidence limit
RCRA	Resource Conservation and Recovery Act
SAP	sampling and analysis plan
SVOC	semivolatile organic compound
TFF	Tank Farm Facility
UCL	upper confidence limit
VOC	volatile organic compound

Data Quality Assessment Report for the Post-Decontamination Characterization of the Contents of Tank WM-183 at the Idaho Nuclear Technology and Engineering Center Tank Farm Facility

1. INTRODUCTION

This report assesses the quality of data generated from liquid tank residuals collected following decontamination of Tank WM-183 at the Idaho Nuclear Technology and Engineering Center Tank Farm Facility (TFF). The purpose of this data quality assessment (DQA) report is to

1. Verify that correct assumptions were made in the development of the data quality objectives (DQOs) about the variance of the sample population

2. Confirm that the number of samples collected was adequate

3. Compare the mean concentration (as represented by the upper confidence limit [UCL]) of Resource Conservation and Recovery Act (RCRA) constituents to approved action levels (ALs) listed in the closure plan (DOE-ID 2003a)

4. Compare the mean concentrations of radionuclides to the inventory prepared for the performance assessment (DOE-ID 2003b)

5. Determine if the data distribution is normal or log normal to justify the assumption of normality (normal distribution) in the DQOs.

In general, DQA provides a scientific and statistical evaluation of data to determine if the collected data are of the right type, quality, and quantity to support their intended use. The DQA process is designed around the key idea that data quality, as a concept, is only meaningful when it directly relates to the intended use of the data (EPA 2000a). Two primary questions can be answered using the DQA process:

1. Does the quality of the data permit decisions to be made with the desired degree of confidence?

2. How well can the sampling design be expected to perform over a wide range of possible outcomes? That is, can the sampling design strategy be expected to perform well in a similar study with the same degree of confidence even if the actual measurements are different than those obtained in the present study?

The first question addresses the immediate needs of the study. If the assessment shows that the data are of sufficient quality, then the decision-maker can make decisions using unambiguous data with the desirable level of confidence (specified during data collection planning). However, if the data do not provide sufficiently strong evidence to support one decision over another, then appropriate data analysis can alert the decision-maker to the degree of ambiguity in the data. If this is the case, an informed decision can be made about how to proceed. For example, based on the data obtained, more data may be collected or the decision-maker may make a decision knowing there is a greater-than-desirable uncertainty in the decision.

The second question addresses the potential future needs of the study. After the DQA is completed, personnel can determine how well the sampling design may perform at a different location given that different environmental conditions and outcomes may exist. Because environmental conditions vary from location to location, it is important to examine the sampling design over a large range of possible settings to ensure that the design will be adequate in other scenarios.

Evaluation of collected data, referred to as the data life cycle, consists of three steps: planning, implementation, and assessment. The planning phase consists of documenting the data needs and plans for data collection using the DQO process (EPA 2000b). The DQOs define the qualitative and quantitative criteria for specifying the sampling procedure and establish the desired level of confidence for decision-making. The DQOs for this project are documented in the associated sampling and analysis plan (SAP) (INEEL 2002). The implementation phase consists of collecting the necessary data according to the SAP. Data assessment consists of both data validation (to make sure that all sampling and analysis protocols were followed) and the use of the validated data set (to determine if the data quality is satisfactory for making the decisions specified in the SAP).

The steps of the DQA process are:

1. Review the DQOs and sampling design

2. Conduct a preliminary data review

3. Select a statistical test

4. Verify the assumptions of the selected test

5. Draw conclusions from the data.

These steps are discussed in the following sections.

2. REVIEW OF THE DATA QUALITY OBJECTIVES AND SAMPLING DESIGN

The DQOs clearly define the principle study questions and issues being addressed and develop the approach that will be taken to resolve that problem. The DQOs consist of developing a problem statement and a decision statement, defining the decision inputs, defining study boundaries, developing a decision rule, establishing decision error limits, and optimizing the design.

1. Problem Statement: Demonstrate that tank decontamination activities have resulted in closure performance objectives being met.

2. Decision Statement: Determine whether decontamination of the TFF tank systems reduced the concentrations of constituents or properties (i.e., pH) of concern in the residuals remaining in the TFF system components below closure performance standards; if not, further decontamination may be necessary or the Hazardous Waste Management Act (HWMA)/RCRA landfill standards for closure must be met. Department of Energy (DOE) requirements also must be met to close the tanks in place.

3. Decision Inputs: Concentrations of hazardous constituents and radionuclides present in the tanks after decontamination.

4. Study Boundaries:

   a. Spatial Boundaries: Residual decontamination fluids remaining in the tanks following decontamination. The data assessed in this report were generated from the sample analysis of residual tank liquids remaining after decontamination. No data from the sample analysis of residual solids or the liquids from the tank vault sumps or diversion valve boxes are analyzed in this report. Data assessment of sample analysis of ancillary equipment will be addressed in a subsequent report.

   b. Temporal Boundaries: From the onset of decontamination to completion of decontamination. The length of time can vary from tank to tank. Decisions made concerning achievement of closure performance standards will apply for a minimum of 100 years of DOE institutional control.

   c. Scale of Decision-Making: The assumptions made in developing the performance assessment (DOE-ID 2003b) will specify the scale of decision-making.

   d. Practical Constraints: It is not possible to obtain samples from all areas of the tank because of restricted access points and limitations on the available sampling methods.

5. Decision Rule: The parameter of interest is the mean concentration of the constituents of concern within the study boundaries. The decision rules are:

   a. *If* the true mean (as estimated by the 95% UCL of the sample mean) concentration of any applicable hazardous waste constituent detected from the tank is greater than or equal to the maximum concentration of contaminants for the toxicity characteristic listed in 40 Code of Federal Regulations (CFR) 261.24 (2004), or *If* the true mean pH (as estimated by the lower confidence limit [LCL] and UCL of the 95% confidence interval of the sample mean for pH) of TFF residuals collected from any individual tank or vault sump exhibit the characteristic of corrosivity, *then* either additional decontamination steps will be undertaken or closure to HWMA/RCRA landfill standards will be considered.

b. *If* the true mean (as estimated by the 95% UCL of the sample mean) concentration of any hazardous constituent detected in total constituent analyses of the TFF residuals collected from statistically similar populations (i.e., sample locations) is greater than or equal to the AL specified in the closure plan, *then* additional decontamination steps may be undertaken. Closure to HWMA/RCRA landfill standards will be considered at final closure of the TFF.

c. *If* the concentrations of hazardous constituents indicate that the closure performance standards have been met, *then* the TFF will be closed under a HWMA/RCRA clean closure.

6. Decision Error Limits: The outputs for the decision error limits are the null and alternative hypotheses and a quantification of the allowable error rates. The null hypothesis is "The concentration of at least one hazardous or radioactive constituent in TFF residuals following decontamination is equal to or exceeds action levels." Conversely, the alternative hypothesis is "The concentrations of all hazardous or radioactive constituents in TFF residuals following decontamination are less than the specified action levels." The lower boundary of the gray region (Δ) is set at 80% of the AL for all constituents of concern. Using the stated null hypothesis, the upper boundary of the gray region is always the constituent-specific AL. For pH, the gray region is bounded on one side by 2.0 and 12.5 (the ALs) and on the other side by 2.1 and 12.4, respectively. In the case of acidic conditions (low pH), the "lower boundary" of the gray region is actually a pH value greater than the action limit because the "lower boundary" of the gray region is always in a direction away from the action limit that would result in rejection of the null hypothesis if the true mean value was equal to that value. That is, the gray region is that range of values where controlling false negative decision error is deemed unimportant relative to the cost of controlling that error. The chance of a false-positive decision error (α) and the chance of a false-negative decision error (β) will both be set at 5%.

7. Design Optimization: A simple random sampling method was used to obtain samples. The standard deviation (σ) was estimated to be 10% of the AL. The validity of this assumption is assessed later in this DQA report. Given the chosen α, β, and Δ in conjunction with the estimated value for σ, a sample size (n) of 5 was selected using Equation (1):

$$n=\frac{\left(z_{1-\alpha}+z_{1-\beta}\right)^2\sigma^2}{\Delta^2}+\frac{1}{2}z_{1-\alpha}^{2} \tag{1}$$

where

n	=	the appropriate number of samples to collect to satisfy the DQOs
z_x	=	the z value for the xth quantile of the standard normal distribution (from statistical tables)
α	=	false-positive rate (5% or 0.05)
β	=	false-negative rate (5% or 0.05)
σ	=	estimated standard deviation of the population

Δ = minimum detectable difference (the difference between the AL and the value at which the decision-maker wants to specify a false-negative decision error rate; in this case, Δ is 20% of the constituent-specific AL).

Equation (2) shows the solution of this formula for the Tank WM-183 sampling and analysis activity:

$$n = \frac{(1.645 + 1.645)^2 (10)^2}{(20)^2} + \frac{1}{2}(1.645)^2 = 4.06 \tag{2}$$

Based on the results of Equation (2), five samples of the residual decontamination fluids remaining in the tank were collected for the applicable analyses.

3. PRELIMINARY DATA REVIEW

The purpose of the preliminary data review is to examine the data using graphical methods and numerical summaries to gain familiarity with the data and achieve an understanding of the "structure" of the data. A preliminary data review should be performed whenever data are used, regardless of the data use. This type of examination allows for identification of appropriate approaches for further analysis and limitations of the data. The two main approaches to a preliminary data review are: (1) calculation of basic statistical quantities (or summary statistics) and (2) graphical representations of the data. Appendixes A–E of this report provide the graphical representation of Tank WM-183 data. The calculated summary statistics will be discussed in this section, and the graphical review of the data will be discussed in Section 5 when distribution of the data is assessed.

The summary statistics that were calculated for the detected constituents were measures of center (mean and median) and measures of spread (standard deviation, coefficient of variation [CV], interquartile range, and range). One measure that is of primary interest is the center of the data. The average ($\bar{x}$), or the mean, is the most commonly used measure of the central tendency of the data. However, it can be heavily influenced by outliers and by nonsymmetric data. The mean is calculated using Equation (3):

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} \tag{3}$$

where

$\bar{x}$ = mean

n = number of observations

x_i = i^{th} observation.

The median is the preferred measure of the center of the data if outliers are present in the data or if the data are skewed. The median is the observation such that 50% of the data lie below the median and 50% of the data lie above the median. If the data are symmetric, the mean and the median will be equal to each other.

Another quantity of interest is the spread of the data. The standard deviation (s) is the most commonly used measure of spread. One reason for this is that it is fairly easy to interpret and is used in many other statistical methods. Because it is calculated using the average, it is also sensitive to outliers and to data that are not symmetric. The standard deviation is calculated using Equation (4):

$$s = \sqrt{\frac{\sum_{i=1}^{n} \left(x_i - \bar{x}\right)^2}{n-1}} \tag{4}$$

where

s = standard deviation

n = number of observations

x_i = i^{th} observation

$\bar{x}$ = mean of the observations.

The CV was also calculated for each detected analyte. The CV is a relative measure of variation. That is, it is a measure of the standard deviation relative to the mean, expressed as a percentage. This measure provides a way to more directly compare the standard deviations of two different data sets that may otherwise not be directly comparable. However, it is important to note that the mean of the data may be very close to zero or very far away from zero and the spread may be independent from the distance of the mean from zero. Therefore, no firm guidelines have been established for interpreting the CV. The formula for calculating the CV is:

$$CV = \frac{s}{\overline{X}} \times 100\% \tag{5}$$

The interquartile range is a measure of spread that is not influenced by outliers. It is calculated by subtracting the first quartile from the third quartile. The first quartile is the 25th percentile of the data and the third quartile is the 75th percentile of the data. The interquartile range is a preferred measure of spread when extreme outliers exist in the data. Otherwise, the standard deviation is the preferred measure of spread.

Another measure of spread is the range of the data. The range is calculated by subtracting the smallest value in the data from the largest value. It can be a valuable piece of information in characterizing the spread of the data but can be deceptively large if the data contain any outliers. Therefore, the data should always be examined for outliers when the range is used as a summary statistic.

The five-number summary was calculated for pH and each of the detected organic, inorganic, and radionuclide analytes. The five-number summary is a presentation of the minimum value, the first quartile, the median, the third quartile, and the maximum value of the data. This summary provides non-parametric information about the general spread and pattern of the data.

It is often difficult to read a table of numerical summary statistics and identify the degree of symmetry or normality of the data. Therefore, the graphical representations are shown in Appendixes A–E to aid the data user in assessing the symmetry and normality of the data collected. Graphical representations of the data include boxplots and normal-quantile plots. Boxplots are a way of graphically viewing the five-number summary. The plot consists of a central box with a line or other mark inside of the box. Two lines come out of the ends of the box in either direction. The line, or mark, inside the box represents the median, the edges of the box represent the two quartiles, and the extreme ends of the lines represent the largest and smallest observations within 1.5 interquartile range from the box, which are the minimum and maximum values in this study. This type of plot allows for a quick and comprehensive analysis of the symmetry of the data. It can be easily determined if the data are symmetric, right-skewed, or left-skewed. Right-skewed data have a lengthened tail on the higher values of the distribution. This tail pulls the mean toward it, causing the mean to be high relative to the center of the data. This makes it more likely that a tank will be declared insufficiently decontaminated when, in fact, it is sufficiently clean.

Left-skewed data have a lengthened tail on the lower values of the distribution. This tail pulls the mean toward it causing the mean to be lower than the center of the data. Left-skewed data will cause the UCL to be low-biased, making it more likely to show the tank is clean when, in fact, the concentration of that analyte exceeds the AL. The normal-quantile plot is a plot that is used to assess the normality of the data. If the data follow a normal distribution then the points on the graph will lie along a straight line. Any deviations from a straight line are indicative of deviations from normality. If the tails bend away from the line at both of the ends of the line, then the data are asymmetric. If the data veer away from the line at only one end, then the tails of the distribution are either too heavy or too light to assume a normal distribution. It is important to note that no real world data set is perfectly normal so a certain amount of deviation from the line is to be expected, even in data that are sufficiently normal.

The following subsections provide an overall analysis of the data pertaining to the samples collected from the post-decontamination tank contents. Because decontamination activities reduced the volume of solids remaining in the tank to less than 15% by volume of the total sample collected, the solids portion of the samples collected were not analyzed and compared with the ALs for regulated constituents. Samples taken from Tank WM-183 were analyzed for organic, inorganic, and radionuclide constituents. Because analytical results for chromium and mercury from the original sampling event for Tank WM-183 exceeded the corresponding action limits, additional decontamination was performed and additional samples were collected for analysis of the metals and gamma-emitting radionuclides. The data generated from the original sampling event were used for the miscellaneous inorganic, organic, and radiochemistry analyses. These “original” data represent a conservative or biased high estimation of the population for the final contents of Tank WM-183, and their use demonstrates a conservatively high estimate of the analyte concentrations. A comparison of the original data with the data collected after additional decontamination indicates that the second decontamination effectively reduced liquid tank residual concentrations of metals and gamma-emitting radionuclides by greater than 90% (see Table 1).

Each type of analyte (organic constituents, metals, anions, pH, and radionuclides) is discussed separately. The impact of laboratory performance on the data quality is discussed, and detected analytes are examined statistically.

3.1 Organic Constituents

Samples collected from Tank WM-183 were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and polychlorinated biphenyls. Data generated from these analyses were validated in accordance with technical procedures, and data validation flags were assigned to results based on laboratory performance on associated quality control analyses.

In the VOC analyses, anomalies were encountered with the acetone results. The acetone concentrations from the initial analyses exceeded the calibration range for the compound. Therefore, the samples were diluted, and the analyses were repeated. The acetone concentrations from the dilution analyses were lower than would be expected based on the initial, undiluted results. Although use of data that exceed the calibration range is atypical, use of the undiluted sample results was deemed to be more reliable given the analytical anomalies encountered. The acetone concentrations detected were ultimately qualified by the validator as “undetected” and assigned “U”-flags because of levels of lab blank contamination. Other minor discrepancies noted in the validation report (Environmental Validation & Assessment Consultants 2003a) should not negatively impact the data usability.

Analytical anomalies were also encountered in the generation of SVOC data. The sample matrix caused degradation of the column within the analytical instrumentation, resulting in elevated baselines, low recovery of the acid components, and delayed retention times for the acid components. The original sample results were considered to be severely compromised and were not used in this DQA. The samples could not be re-extracted because insufficient volume remained. Rather, the original extract was reinjected. Surrogate recoveries for the acid fraction compounds were low and internal standard areas were low in the reinjection analyses. In addition, the sample extracts were reinjected outside the 40-day holding time specified for analysis of SVOCs. Consequently, all undetected results were rejected and qualified with an "R"-flag and all positive results were qualified as estimated values and qualified with "J"-flags (Environmental Validation & Assessment Consultants 2003b) to denote a potential low bias.

Table 1. Comparison of the data that were originally collected from Tank WM-183 and the metals and gamma-emitting radionuclide concentrations that were measured after the tank was rewashed.

	Original Sampling			Post Additional-Decontamination Sampling				
Detected Analyte	Average Concentration	95% UCL	Units	Average Concentration	95% UCL	Units	Comments	% Reduction
Metals								
Aluminum	5.43E+04	6.92E+04	µg/L	2.65E+02	3.26E+02	µg/L		99.5
Arsenic	4.26E+00	5.14E+00	µg/L	ND[a]	ND	µg/L		NA[b]
Barium	8.12E+01	1.24E+02	µg/L	1.38E+00	1.74E+00	µg/L		98.6
Beryllium	2.60E–01	2.60E–01	µg/L	ND	ND	µg/L		NA
Cadmium	3.78E+02	4.65E+02	µg/L	1.50E+00	1.87E+00	µg/L		99.6
Chromium	1.85E+03	2.42E+03	µg/L	8.12E+00	1.09E+00	µg/L		99.5
Cobalt	2.55E+01	3.14E+01	µg/L	ND	ND	µg/L		NA
Copper	1.02E+02	1.27E+02	µg/L	2.14E+00	3.79E+00	µg/L		97.0
Iron	1.57E+03	2.64E+03	µg/L	4.42E+02	7.32E+02	µg/L		72.3
Lead	1.76E+02	2.42E+02	µg/L	8.04E+00	9.37E+00	µg/L		96.1
Manganese	1.98E+03	2.49E+03	µg/L	9.96E+00	1.26E+01	µg/L		99.5
Mercury	4.53E+03	5.32E+03	µg/L	6.60E+01	7.31E+01	µg/L		98.6
Nickel	1.21E+03	1.47E+03	µg/L	8.98E+00	1.07E+01	µg/L		99.3
Silver	1.37E+02	1.62E+02	µg/L	3.77E+01	4.63E+01	µg/L		71.4
Vanadium	1.44E+00	1.81E+00	µg/L	ND	ND	µg/L		NA
Zinc	2.40E+02	2.81E+02	µg/L	1.75E+01	1.94E+01	µg/L		93.1
Metals average								**93.7**
Radionuclides								
^{60}Co	2.01E+05	2.31E+05	pCi/L	2.74E+03	5.91E+03	pCi/L	Only one positive sample after rewash	97.4
^{134}Cs	1.14E+05	2.03E+05	pCi/L	9.97E+03	1.98E+04	pCi/L	Three positive samples from first sampling, only one positive after rewash	90.2
^{137}Cs	6.41E+08	6.73E+08	pCi/L	7.59E+07	1.03E+08	pCi/L		84.8

Table 1. (continued).

	Original Sampling			Post Additional-Decontamination Sampling				
Detected Analyte	Average Concentration	95% UCL	Units	Average Concentration	95% UCL	Units	Comments	% Reduction
Radionuclides (continued)								
^{154}Eu	1.57E+06	1.89E+06	pCi/L	6.06E+03	9.75E+03	pCi/L	Only one positive sample from first sampling and rewash	99.5
^{155}Eu	3.11E+05	5.55E+05	pCi/L	ND	ND	pCi/L		NA
^{94}Nb	2.33E+04	5.56E+04	pCi/L	3.53E+03	7.48E+03	pCi/L	Two positive samples from first sampling, only one positive after rewash	86.6
^{103}Ru	1.64E+05	4.73E+05	pCi/L	ND	ND	pCi/L		NA
^{125}Sb	6.67E+05	1.57E+06	pCi/L	1.19E+05	2.49E+05	pCi/L	Only two positive samples from first sampling and rewash	84.2
^{99}Tc[c]	7.26E+04	8.85E+04	pCi/L	1.10E+03	1.68E+03	pCi/L		98.1
^{95}Zr	9.34E+04	9.88E+04	pCi/L	ND	ND	pCi/L	UCL original exceeds action limit	NA
Radionuclides average								**92.9**

a. Not detected.

b. Not applicable.

c. Analyzed by inductively coupled plasma-mass spectrometry (ICP-MS).

The impact of any potential for low bias was investigated by an independent professional engineer (Jason Associates Corporation 2004) to ensure that the SVOC data generated could be used to determine whether the closure standards were met. In the course of that investigation, the potential low bias was determined to be limited to the acid fraction compounds. Therefore, conservative assumptions were made to determine what the worse-case concentrations of these compounds could have been. Hypothetical ALs were calculated for the compounds. A study of the impact of the worse-case concentrations shows that the hypothetical ALs with the additional compounds were met (Stanisich 2004). None of the conservative assumptions negatively impacted meeting the closure standards. Therefore, the results of the evaluation was that even though aspects of the SVOC analytical data may be questioned, the data can be used to generate reasonable, conservative assumptions as to what the worse-case data could have been. Since the worse-case data still show the ALs are met, the analytical data should be considered adequate to support the closure plan. The previous data from initial characterization and post-decontamination of WM-182 and subsequent data generated from decontamination of the three additional tanks (WM-184, WM-185, and WM-186 [Environmental Validation & Assessment Consultants 2004a, 2004b, 2004c]) all support the conclusion that these acid fraction SVOC compounds are not present in WM-183.

Results reported for phthalates were deemed in this DQA as unreliable based on the fact that these compounds were not detected in any initial characterization sampling of the tank (before conducting any decontamination activities) and that these compounds are notorious laboratory contaminants. Results reported for organic compounds that have been detected in previous analyses associated with tank closure were included in this DQA because the concentrations reported herein were comparable to those previous detections. The degradation of the analytical system likely accounts for the numerous tentatively identified compounds reported. This DQA includes the evaluation of the one tentatively identified compound that was reported in all five samples.

The data usability should not be negatively impacted by the validation qualifying flags assigned to the polychlorinated biphenyl sample results (Environmental Validation & Assessment Consultants 2003c). Undetected results in two samples were qualified as estimated values (denoted by "UJ" flags) because of surrogate recoveries that were within the laboratory acceptance limits but outside the validation procedure guidelines. Surrogate recoveries were acceptable in all other quality control analyses.

Most of the organic constituents of concern were not detected in the post-decontamination tank contents. Table 2 lists the organic constituents of concern that were detected and also identifies compounds that were detected but have no action limits associated with tank closure. Table 3 presents the measures of central tendency and spread for organic analytes. Table 4 provides the five-number summary for each of the detected analytes. Laboratory results and associated validation flags for organics data presented in this DQA are listed in Appendix F.

As shown in the summary statistics and the boxplots, the compounds 2-butanone, pyridine, tri-n-butyl phosphate, and undecanoic acid are non-normal in distribution. 2-butanone has a high outlier. Tri-n-butyl phosphate and undecanoic acid are slightly right-skewed. Right-skewness in the data will pull the mean higher than the true center of the data. Pyridine exhibits a strong skew to the right and a bi-modal distribution, which means that the data are clustered into two distinct groups. This bi-modal distribution occurred because three of the five measurements were undetected results. This is too few measurements to perform a *t*-test; however, the detected concentrations are far below the AL. The analyte 4-nitrophenol had too small a proportion of detected data to perform a *t*-test. The largest detected value was 11.5 µg/L and this analyte has no action limit. Therefore, both pyridine and 4-nitrophenol will be omitted from the discussion of the *t*-test and the normality assessment in Section 5.

Table 2. Organic compounds detected in the Tank WM-183 liquid residuals.

Detected Volatile Organic Compounds		
2-Butanone (methyl ethyl ketone)		
Detected Semivolatiles		
Caprolactam[a]	n-Nitrosodimethylamine	Pyridine
2-Nitrophenol[a]	2,2'-oxybis(1 Chloropropane)[a]	Tri-n-butyl phosphate
4-Nitrophenol	Phenol	Undecanoic acid[b]

a. Compound was detected in one sample. Because only one detection was made, it is not possible to perform statistical analysis of the data set for this analyte.

b. The only tentatively identified compound to be reported in all samples.

Table 3. Summary statistics of central tendency and spread for organic compounds detected in the Tank WM-183 liquid residuals.

Analyte	Mean (µg/L)	Median (µg/L)	Standard Deviation (µg/L)	Coefficient of Variation (%)	Interquartile Range (µg/L)	Range (µg/L)
2-Butanone	22.4	17.3	12.7	56.9	2.10	30.8
4-Nitrophenol	7.3	6.4	3.8	51	6.6	8.2
n-Nitrosodimethylamine	1.8	1.8	0.40	22	0.50	1.0
Phenol	6.3	5.0	3.8	61	7.3	7.6
Pyridine	16.4	10.3	8.50	52.8	14.9	16.2
Tri-n-butyl phosphate	11.2	10.3	2.94	26.1	1.90	7.60
Undecanoic acid [a]	35.4	10.2	40.9	115	51.4	91.9

a. The only tentatively identified compound to be reported in all samples.

Table 4. Five-number summary for organic compounds detected in the Tank WM-183 liquid residuals.

Analyte	Minimum Value (µg/L)	First Quartile (µg/L)	Median (µg/L)	Third Quartile (µg/L)	Maximum Value (µg/L)
2-Butanone	14.1	16.7	17.3	18.8	44.9
4-Nitrophenol	3.3	4.3	6.4	10.9	11.5
n-Nitrosodimethylamine	1.3	1.6	1.8	2.1	2.3
Phenol	2.7	3.0	5.0	10.3	10.3
Pyridine	10.0	10.3	10.3	25.2	26.2
Tri-n-butyl phosphate	8.5	9.7	10.3	11.6	16.1
Undecanoic acid[a]	5.2	6.6	10.2	58.0	97.1

a. The only tentatively identified compound to be reported in all samples.

3.2 Metals

In the analyses for metals, the associated quality control results were within acceptable limits and the sample data were not qualified with validation flags (Portage Environmental, Inc. 2003a). Table 5 lists the metals which were detected in the tank residuals. In Table 6, the measures of central tendency and spread for metals are listed. Table 7 provides the five-number summary for each of the detected analytes. Examination of the data shows that copper, lead, and magnesium are right-skewed. Mercury is left-skewed. Magnesium shows the least degree of asymmetry out of the four analytes. However, two of the five values for magnesium are below the detection limit. This is too low a proportion of detected values in the data to justify the use of a *t*-test for this analyte. The maximum concentration for magnesium was 14.0 µg/L and this analyte has no action limit. It has been omitted from the section pertaining to action level comparison and the normality assessment in Section 5. Three of the five values for lead were below the detection limit. Thus, insufficient data exist to perform a formal statistical hypothesis test pertaining to the action level. Because the greatest detected value of lead was 10.5 µg/L and the action level is 5,000 µg/L, it can be safely assumed that lead meets closure requirements. Lead is not included in further statistical discussion in this document. Laboratory results and associated validation flags for metals data presented in this DQA are listed in Appendix G.

Table 5. Metals detected in the Tank WM-183 liquid residuals.

Aluminum	Iron	Potassium
Barium	Lead	Silver
Cadmium	Magnesium	Sodium
Calcium	Manganese	Zinc
Chromium	Mercury	
Copper	Molybdenum	

Table 6. Summary statistics of central tendency and spread for metals detected in the Tank WM-183 liquid residuals.

Analyte	Mean (µg/L)	Median (µg/L)	Standard Deviation (µg/L)	Coefficient of Variation (%)	Interquartile Range (µg/L)	Range (µg/L)
Aluminum	265	244	64.6	24.4	96.0	151
Barium	1.38	1.40	0.377	27.3	0.300	1.00
Cadmium	1.50	1.40	0.387	25.8	0.600	0.900
Calcium	56.7	57.4	6.47	11.4	9.30	15.6
Chromium	8.12	6.80	2.96	36.5	5.10	6.30
Copper	2.14	1.50	1.73	80.8	0.400	4.20
Iron	442	320	304	68.8	436	713
Lead	8.04	7.30	1.39	17.3	0.500	3.20
Magnesium	12.4	11.0	2.06	16.6	3.50	4.10
Manganese	9.96	9.00	2.79	28.0	4.50	6.30
Mercury	66.0	70.6	7.42	11.3	6.80	17.1
Molybdenum	20.2	17.8	10.2	50.7	12.8	25.6
Nickel	8.98	9.30	1.73	19.3	2.30	4.30
Potassium	488	466	87.4	17.9	135	203
Silver	37.7	38.1	8.94	23.7	9.20	23.2
Sodium	469	449	74.7	15.9	105	178
Zinc	17.5	16.7	1.99	11.4	3.00	4.60

Table 7. Five-number summary of metals detected in the Tank WM-183 liquid residuals.

Analyte	Minimum Value (µg/L)	First Quartile (µg/L)	Median (µg/L)	Third Quartile (µg/L)	Maximum Value (µg/L)
Aluminum	200	216	244	312	351
Barium	0.800	1.30	1.40	1.60	1.80
Cadmium	1.10	1.20	1.40	1.80	2.00
Calcium	49.5	51.2	57.4	60.5	65.1
Chromium	5.20	6.00	6.80	11.1	11.5
Copper	1.00	1.30	1.50	1.70	5.20
Iron	92.6	278	320	714	806
Lead	7.30	7.30	7.30	7.80	10.5
Magnesium	10.8	10.8	11.0	14.3	14.9
Manganese	7.20	7.80	9.00	12.3	13.5
Mercury	53.8	63.9	70.6	70.7	70.9
Molybdenum	7.10	15.3	17.8	28.1	32.7
Nickel	6.80	7.70	9.30	10.0	11.1
Potassium	400	418	466	553	603
Silver	27.5	31.6	38.1	40.8	50.7
Sodium	396	411	449	516	574
Zinc	15.5	16.1	16.7	19.1	20.1

3.3 Anions

In the validation of anion data, results were rejected ("R"-flagged) based on the laboratory performance in the serial dilution analysis (Portage Environmental, Inc. 2003b). Poor performance in the serial dilution analysis is likely associated with the sample matrix. Because results from the laboratory control sample analysis were within acceptance limits for both accuracy and precision, the impact to data usability of the serial dilution results was deemed to be minimal. Table 8 presents a list of anions that were detected in the tank residuals. Table 9 presents the measures of central tendency and spread for anions. Table 10 provides the five-number summary for each of the detected anions. Laboratory results and associated validation flags for anions data presented in this DQA are listed in Appendix H.

Preliminary analysis of the anion data shows that nitrate exhibits a strong right-skew in the data. Sulfate also shows some right-skewness in the data but it is not enough to cause concern when selecting a statistical test.

Table 8. Anions detected in the Tank WM-183 liquid residuals.

Chloride	Nitrate
Fluoride	Sulfate

Table 9. Summary statistics of central tendency and spread for anions detected in the Tank WM-183 liquid residuals.

Analyte	Mean (mg/L)	Median (mg/L)	Standard Deviation (mg/L)	Coefficient of Variation (%)	Interquartile Range (mg/L)	Range (mg/L)
Chloride	7.3	7.1	0.85	12	1.1	2.1
Fluoride	6.8	6.8	0.38	5.6	0.40	1.0
Nitrate	148.5	138.9	21.1	14.2	3.70	48.7
Sulfate	22.9	20.6	4.29	18.8	5.70	9.80

Table 10. Five-number summary for anions detected in the Tank WM-183 liquid residuals.

Analyte	Minimum Value (mg/L)	First Quartile (mg/L)	Median (mg/L)	Third Quartile (mg/L)	Maximum Value (mg/L)
Chloride	6.2	6.9	7.1	8.0	8.3
Fluoride	6.4	6.6	6.8	7.0	7.4
Nitrate	137.5	138.2	138.9	141.9	186.2
Sulfate	19.4	19.7	20.6	25.4	29.2

3.4 Analysis of pH

The pH of the samples collected from the Tank WM-183 post-decontamination residuals was also measured. The data in Tables 11 and 12 show the summary statistics and the five-number summary for the pH measurements. The data are bi-modal with three measurements that are identical (2.4) and two measurements that are identical (2.3). Variation is very small. Laboratory results and associated validation flags for pH data presented in this DQA are listed in Appendix I.

Table 11. Summary statistics of central tendency and spread for pH detected in the Tank WM-183 liquid residuals.

	Mean	Median	Standard Deviation	Coefficient of Variation (%)	Interquartile Range	Range
pH	2.4	2.4	0.1	2.3	0.1	0.1

Table 12. Five-number summary for pH detected in the Tank WM-183 liquid residuals.

	Minimum Value	First Quartile	Median	Third Quartile	Maximum Value
pH	2.3	2.3	2.4	2.4	2.4

3.5 Radionuclides

Samples collected from Tank WM-183 for analysis of radionuclides provided analytical data that are generally of high quality (Portage Environmental, Inc. 2003c, 2003d; Storms 2004).

Total strontium analysis was used as a method to determine ^{90}Sr. All isotopes of strontium other than ^{90}Sr are short-lived and would not be present in the tank residuals.

Please note that the ^{236}U analyses were requested but not conducted by the laboratory. ^{235}U and ^{236}U isotopes are commonly analyzed and reported as a single result because their respective energies fall in the same region of interest. It is reasonable to consider the ^{235}U data reported by the laboratory as a combination $^{235/236}U$ result.

Summary statistics were generated for the radionuclide data. Table 13 lists the radionuclides that were detected in liquid residual taken from Tank WM-183, Table 14 lists the statistical summary of central tendency and spread for detected radionuclides, and Table 15 provides the five-number summary for each of the detected radionuclides. When analytes were reported below the detection limit, one-half of the corresponding minimum detectable activity was used in the calculations (EPA 2000a). Laboratory results and associated validation flags for radionuclides data presented in this DQA are listed in Appendix J.

The preliminary analysis of the radionuclide data shows that ^{14}C, ^{63}Ni, and ^{3}H are right-skewed. However, the asymmetry in ^{63}Ni is very small and will not pose a problem with the selection of a statistical test. ^{241}Pu is slightly left-skewed. ^{14}C, ^{226}Ra, ^{125}Sb have three measurements that are below the detection limit and ^{238}U has two values that are below the detection limit. This is too small a proportion of detected data to perform a *t*-test. **All of these radionuclides are comfortably below their respective inventory levels.** The maximum value of ^{14}C is 1.72E+01 pCi/L with an inventory level of 9.90E+07 pCi/L. ^{125}Sb has a maximum value of 3.18E+05 pCi/L with an inventory level of 1.49E+06 pCi/L. ^{238}U has a maximum value of 7.40E+01 pCi/L with an action level of 1.64E+04 pCi/L. Due to the high proportions of values below the detection limit, ^{14}C, ^{125}Sb, and ^{238}U will be omitted from the discussions pertaining to the *t*-test and the normality of the data.

Table 13. Radionuclides detected in the Tank WM-183 liquid residuals.

^{241}Am	$^{154}Eu^{a}$	^{99}Tc
^{125}Sb	^{129}I	Total Sr (^{90}Sr)
^{14}C	^{237}Np	^{3}H
$^{60}Co^{a}$	^{63}Ni	^{234}U
$^{134}Cs^{a}$	$^{94}Nb^{a}$	^{235}U
^{137}Cs	^{238}Pu	^{238}U
^{242}Cm	^{239}Pu	
^{244}Cm	^{241}Pu	

a. This analyte was detected in only one sample. Because only one detection was made, it is not possible to perform statistical analysis of the data set for this analyte.

Table 14. Summary statistics of central tendency and spread for radionuclides detected in the Tank WM-183 liquid residuals.

Analyte	Mean (pCi/L)	Median (pCi/L)	Standard Deviation (pCi/L)	Coefficient of Variation (%)	Interquartile Range (pCi/L)	Range (pCi/L)
^{241}Am	1.83E+05	1.83E+05	1.44E+04	7.86E+00	7.00E+03	4.00E+04
^{14}C	1.09E+01	6.90E+00	5.46E+00	5.01E+01	9.60E+00	1.03E+01
^{137}Cs	7.59E+07	6.38E+07	2.79E+07	3.68E+01	4.26E+07	6.37E+07
^{242}Cm	2.33E+02	2.42E+02	8.20E+01	3.52E+01	7.50E+01	2.19E+02
^{244}Cm	3.81E+03	3.92E+03	8.07E+02	2.12E+01	1.50E+03	1.71E+03
^{3}H	5.27E+05	4.53E+05	1.22E+05	2.31E+01	2.14E+05	2.42E+05
^{129}I	1.22E+03	1.15E+03	3.27E+02	2.68E+01	4.84E+02	7.80E+02
^{63}Ni	2.54E+05	2.25E+05	5.07E+04	2.00E+01	6.40E+04	1.17E+05
^{237}Np	2.56E+03	2.63E+03	5.89E+02	2.30E+01	8.50E+02	1.41E+03
^{238}Pu	6.63E+05	4.98E+05	3.87E+05	5.84E+01	5.02E+05	9.26E+05
^{239}Pu	2.18E+05	1.64E+05	1.24E+05	5.71E+01	1.66E+05	2.96E+05
^{241}Pu	1.01E+05	1.03E+05	3.48E+04	3.43E+01	2.60E+04	8.61E+04
^{125}Sb	1.19E+05	2.48E+04	1.37E+05	1.15E+02	1.83E+05	2.97E+05
Total Sr	6.94E+08	7.28E+08	1.84E+08	2.65E+01	2.38E+08	4.46E+08
^{99}Tc	1.10E+03	1.06E+03	5.58E+02	5.09E+01	7.02E+02	1.26E+03
^{234}U	1.32E+03	1.30E+03	3.29E+02	2.49E+01	4.00E+02	8.00E+02
^{235}U	7.01E+01	6.40E+01	3.81E+01	5.43E+01	4.57E+01	9.58E+01
^{238}U	4.62E+01	5.23E+01	2.76E+01	5.98E+01	5.10E+01	5.848E+01

Table 15. Five-number summary for radionuclides detected in the Tank WM-183 liquid residuals.

Analyte	Minimum Value (pCi/L)	First Quartile (pCi/L)	Median (pCi/L)	Third Quartile (pCi/L)	Maximum Value (pCi/L)
^{241}Am	1.62E+05	1.80E+05	1.83E+05	1.87E+05	2.02E+05
^{14}C	6.90E+00[a]	6.90E+00[a]	6.90E+00[a]	1.65E+01	1.72E+01
^{137}Cs	4.73E+07	5.74E+07	6.38E+07	1.00E+08	1.11E+08
^{242}Cm	1.19E+02	1.95E+02	2.42E+02	2.70E+02	3.38E+02
^{244}Cm	2.90E+03	3.06E+03	3.92E+03	4.56E+03	4.61E+03
^{3}H	4.29E+05	4.34E+05	4.53E+05	6.48E+05	6.71E+05
^{129}I	8.40E+02	9.96E+02	1.15E+03	1.48E+03	1.62E+03
^{63}Ni	2.12E+05	2.20E+05	2.25E+05	2.84E+05	3.29E+05
^{237}Np	1.92E+03	2.04E+03	2.63E+03	2.89E+03	3.33E+03
^{238}Pu	2.94E+05	4.00E+05	4.98E+05	9.02E+05	1.22E+06
^{239}Pu	9.71E+04	1.35E+05	1.64E+05	3.01E+05	3.93E+05
^{241}Pu	4.39E+04	1.02E+05	1.03E+05	1.28E+05	1.30E+05
^{125}Sb	2.12E+04[a]	2.45E+04[a]	2.48E+04[a]	2.07E+05	3.18E+05
Total Sr	5.03E+08	5.26E+08	7.28E+08	7.64E+08	9.49E+08
^{99}Tc[b]	4.99E+02	7.28E+02	1.06E+03	1.43E+03	1.76E+03
^{234}U	1.02E+03	1.04E+03	1.30E+03	1.44E+03	1.82E+03
^{235}U	2.92E+01	4.33E+01	6.40E+01	8.90E+01	1.25E+02
^{238}U	1.56E+01[a]	1.90E+01[a]	5.23E+01	6.99E+01	7.40E+01

a. When the analyte was not detected, half the minimum detectable activity was used.

b. Only four samples were analyzed for ^{99}Tc.

4. STATISTICAL TEST SELECTION

Once the preliminary data review has been completed, an appropriate statistical hypothesis test may be selected to answer the question(s) for which the data were collected. The data are analyzed to determine whether the data meet the assumptions of the desired test(s).

One of the primary requirements of many hypothesis tests is that the data follow a normal distribution. Tests that require the assumption of normality are generally more efficient than either non-parametric tests or tests that do not have a distributional assumption. That is, a test that requires the data to be normally distributed can provide more accurate and reliable answers with fewer data points than a test that does not require the data to conform to a specific distribution. Data not demonstrating a normal distribution can be transformed and used if the transformed data are normally distributed.

Non-parametric tests are most appropriate if the data do not follow a normal distribution. Although they do not require the data to exhibit a normal distribution, most non-parametric hypothesis tests also have assumptions that must be met. One of the most common assumptions for a one-sample non-parametric test is that the data are symmetric. The assumptions of a selected hypothesis test, whether parametric or non-parametric, must be verified before the test is performed on the data.

The primary questions to be answered in relation to the post-decontamination contents of Tank WM-183 are:

- Does the mean concentration of any constituent of concern exceed the specified AL or radionuclide inventory?
- Do the data support the assumptions of variance (standard deviation squared) and normal distribution?

The appropriate test to answer the first question compares the sample mean to a constituent-specific AL. Three primary tests are appropriate for answering this type of question: the one sample *z*-test, Student's one-sample *t*-test, and the Wilcoxin signed rank test.

The *z*-test requires: (a) knowledge of the population standard deviation (σ) and (b) that the data follow a normal distribution. Because the population standard deviation for each constituent concentration in the post-decontamination contents of Tank WM-183 is not known, the *z*-test will not be considered further. The *t*-test allows the use of the sample standard deviation (s), which is an estimate of σ. The *t*-test also requires that the data follow an approximate normal distribution unless the sample size is very large (much larger than the five samples collected in this case). The Wilcoxin signed rank test is a non-parametric test that compares a sample mean to an AL but does not require the data to follow a normal distribution. The primary assumption for this test is that the data are symmetric. If the data are analyzed and found to be neither normally distributed nor symmetric, the data may be transformed. Data are transformed by performing the same operation on each data point (such as taking the natural logarithm of each observation). If the transformed data have a normal distribution or are symmetric, then the appropriate test can be performed on the transformed data. If the UCL of an analyte for which the data has been transformed is desired, it can be calculated using the transformed data. The AL can then be transformed using the same function and directly compared to the UCL within the transformed space.

Because the *t*-test allows use of the sample standard deviation (s) and is a very powerful test for small data sets, the *t*-test was chosen as the most desirable means for testing the null hypothesis. After selecting a statistical test, it is necessary to verify the assumptions of the test selected. These assumptions are examined in Section 5.

5. VERIFICATION OF THE ASSUMPTIONS FOR THE SELECTED HYPOTHESIS TEST

This section examines the underlying assumptions of the statistical hypothesis test in light of the data collected. Both parametric and non-parametric tests require that the samples are independent of each other and this assumption should be verified. In addition, to select the appropriate test, the distributions of the data obtained for each analyte need to be evaluated. Parametric tests, which require the data to be normally distributed, can provide more accurate and reliable answers with fewer data points than non-parametric tests and, therefore, are the preferred tests. Consequently, it must first be determined if the data follow a normal distribution or if they can be transformed to follow a normal distribution. This is done using graphical methods such as histograms and normal-quantile plots. There are statistical tests, such as the Shapiro-Wilk W test or the χ^2 test for distributions that can be used to determine if the data follow a normal distribution, but they have their limitations. If the data set is large, even data that are very close to normal in distribution may not pass the test. If there are a small number of data points, it is difficult for distributional tests to detect deviations from normality in the data. However, the standard deviations for analytes in Tank WM-183 are small compared to the ALs, and the observed concentrations are less than the ALs to such a degree that five samples are adequate for confidently declaring Tank WM-183 sufficiently clean for closure.

In the analysis of the Tank WM-183 rinsate data, graphical methods and the Shapiro-Wilk W test were used to assess normality. Boxplots of the data were prepared using S-Plus 2000 (Insightful Corporation 2000) software. Analyse-It software (Analyse-It 2003) was used to perform the Shapiro-Wilk W test calculations and to construct the normal-quantile plots. Because only five samples were taken from the tank, histograms were not very informative. Normal-quantile plots were the primary graphical method used to evaluate whether the data exhibit a normal distribution. These plots are presented in Appendixes A–E of this report. The assessment of normality of the data is discussed in the following subsections.

Since the primary objective of this DQA analysis is to determine if the mean concentration of a specified analyte is less than its associated AL, the following criteria have been developed in dealing with deviations from normality:

- If the Shapiro-Wilk W test indicates that the data are normally distributed at the $\alpha = 0.05$ level and the summary statistics and plots indicate that the data are symmetric, then the *t*-test will be performed on the raw data.

- If the Shapiro-Wilk W test conclusively shows that the data are normally distributed (the *p*-value is comfortably greater than 0.05), but the boxplot and other summary statistics indicate that the data might be right-skewed, then the raw data will be used for the *t*-test. However, if the data in this situation fail the *t*-test, a transformation that can make the data closer to normal in distribution will be sought and the test will be redone.

- If the *p*-value for the Shapiro-Wilk W test is close to or less than 0.05 and the data are left-skewed, then a transformation will be sought to bring the distribution into the acceptable range of normality.

- If the data are right-skewed and the *p*-value for the Shapiro-Wilk W test is less than 0.05, indicating that the data are non-normal, then an appropriate transformation will be sought for the data.

- If an appropriate transformation cannot be found then the data will be analyzed on a case-by-case basis to determine if it appears that the AL has been exceeded. This will also be done if the data are left-skewed and a suitable transformation cannot be found.

The results of the Shapiro-Wilk W test are reported for all of the reported results as well as for any successful transformations. Results for unsuccessful transformations are not reported because as many as 25 transformations were attempted for each analyte that exhibited non-normality. It is also important to note that the Wilcoxin signed rank test was not considered for data that exhibited non-normality because these data were also non-symmetric. It is possible to determine how the type of asymmetry will affect a *t*-test, but it is not as clear how asymmetry will affect the results of the Wilcoxin signed rank test.

5.1 Verification of Independence Between Risers

One of the primary assumptions for performing the *t*-test is that the samples are independent from one another. The sampling method that was used ensured that the samples that were retrieved from each of the risers were independent of the riser from which they were taken. The contents of the tank were thoroughly mixed and then one sample was taken from each of the risers. Then the contents of the tank were thoroughly agitated again and a sample was taken from each of two randomly selected risers. Since the rinsate came in contact with all surfaces of the tank during agitation and sampling was completed quickly after agitation, each sample had an equal chance of being selected regardless of which riser it was collected from. Therefore, it can be assumed that the sample was truly a simple random sample and that the samples were indeed independent from one another and the location from which they were collected.

5.2 Normality of Organic Data

Normal-quantile plots were constructed for each of the nine detected organic compounds. A normal-quantile plot is read by evaluating how close the data points fall to the line displayed on the plot. If the data points display a good fit to the line, it can be assumed that they follow a normal distribution. Most of the normal-quantile plots constructed for the organic constituent data showed that the data were very close to normal in distribution. It appears from the plots that the normality assumption required for use of the *t*-test was met for these data with the exception of 2-butanone.

The Shapiro-Wilk W test was also done using the data collected for each of these analytes. The W test is an effective method for testing whether a data set has been drawn from an underlying normal distribution. The test involves a calculation that results in a sample value variable (W). To determine if the data show a normal distribution at a specified level of significance, the p-value of W is compared with a significance level based on a tabulated value developed by Shapiro and Wilk. The value from the table represents the quantile for data that are normal at the given level of significance. If the calculated p-value of W is greater than 0.05, then the null hypothesis for the test cannot be rejected (i.e., the underlying data set exhibits a normal distribution). The results of the Shapiro-Wilk W test for the organic constituent data are shown in Table 16.

This test also demonstrates that the organic data, with the exception of 2-butanone, are normal in distribution. Close examination of 2-butanone shows that the data are right-skewed. Performing a double natural logarithm transformation produces normality in the data. This is done by taking the natural log of the natural log of the data ($\ln(\ln x)$). After this transformation is done, the double natural log function is performed on the action level and the transformed action level is compared to the UCL of the transformed data. From this information, it can be concluded that the *t*-test is appropriate for analyzing the detected organic constituents.

Table 16. Results of the Shapiro-Wilk W test for organic constituents.

Analyte	Shapiro-Wilk Coefficient	*p*-value	Non-Normal
2-Butanone	0.6806	0.0059	Yes
2-Butanone (ln (ln *x*)) transformation	0.7971	0.0767	No
n-Nitrosodimethylamine	0.9820	0.9453	No
Phenol	0.8068	0.0920	No
Tri-n-butyl phosphate	0.8796	0.3077	No
Undecanoic acid	0.8067	0.0918	No

5.3 Normality of the Metals Data

Detected metals data were also analyzed using normal-quantile plots and the Shapiro-Wilk W test. Normal-quantile plots and the Shapiro-Wilk W test showed asymmetry in data for copper, lead, and mercury. Several transformations were used in an attempt to obtain data that were normal in distribution. Normality was achieved with copper using an ln x transformation, and normality was achieved with mercury using an e^x transformation.

The Shapiro-Wilk W test was done on the untransformed and transformed data. Table 17 contains the results of the Shapiro-Wilk W test for the metals constituents. Because the calculated *p*-values are greater than 0.05 except for copper, the underlying data set exhibits a normal distribution for metals constituents. Therefore, a *t*-test will be used on the untransformed data of the detected metals with the exception of copper and mercury. (A *t*-test will be performed on the transformed data for copper and mercury.) Although non-normal, the remaining data are right-skewed, creating a conservative bias by pulling the mean toward the AL.

Table 17. Results of the Shapiro-Wilk W test for metals constituents.

Analyte	Shapiro-Wilk Coefficient	*p*-value	Non-Normal
Aluminum	0.9153	0.5004	No
Barium	0.9564	0.7828	No
Cadmium	0.9201	0.4303	No
Calcium	0.9494	0.7327	No
Chromium	0.8371	0.1571	No
Copper	0.6967	0.0088	Yes
Copper (ln *x* transformation)	0.8356	0.1533	No
Iron	0.9064	0.4465	No
Manganese	0.8909	0.3619	No
Mercury	0.7672	0.0426	Yes
Mercury (with e^x transformation)	0.8184	0.1136	No
Molybdenum	0.9622	0.8235	No
Nickel	0.9685	0.8655	No
Potassium	0.9176	0.5145	No
Silver	0.9424	0.8903	No
Sodium	0.9242	0.5575	No
Zinc	0.8982	0.3999	No

5.4 Normality of the Anions Data

Detected anions were analyzed using normal-quantile plots and the Shapiro-Wilk W test. The normal-quantile plots show asymmetry in the nitrate data. No successful transformation was found for the nitrate data. Because nitrate data are right-skewed, the Shapiro-Wilk W test was done on untransformed data for all anions. Table 18 contains the results of the Shapiro-Wilk W test for the anions data. With the exception of the nitrate data, the Shapiro-Wilk W test also indicates that the data are sufficiently normal in distribution for use of the *t*-test. From this, it was concluded that the *t*-test is appropriate for use with untransformed anions data.

Table 18. Results of the Shapiro-Wilk W test for anions.

Analyte	Shapiro-Wilk Coefficient	*p*-value	Non-Normal
Chloride	0.9516	0.7488	No
Fluoride	0.9787	0.9276	No
Nitrate	0.6201	0.0011	Yes
Sulfate	0.8444	0.1773	No

5.5 Normality of the pH Data

Normality was also assessed for the pH data. The normal-quantile plot showed that there may be some concerns with the normality of the data. The Shapiro-Wilk W test results are included in Table 19. The data for pH are skewed to the left. This means that the LCL will be conservatively low. Therefore, if the LCL is greater than the lower AL, it can be assumed that the lower AL has not been exceeded. Otherwise, the data must be reexamined to determine if non-parametric methods might be more appropriate.

Table 19. Results of the Shapiro-Wilk W test for pH.

Analyte	Shapiro-Wilk Coefficient	*p*-value	Non-Normal
pH	0.6840	0.0065	Yes

5.6 Normality of the Radionuclide Data

Detected radionuclide data were also analyzed using normal-quantile plots and the Shapiro-Wilk W test. Normal-quantile plots showed asymmetry in data for ^3H. Several transformations were used on ^3H in an attempt to obtain data that were closer to normal in distribution. A successful transformation could not be found for ^3H. However, the ^3H data are right-skewed and will produce a conservative UCL. The Shapiro-Wilk W test was done on the transformed and untransformed data. However, because no successful transformations were found, Table 20 contains the results of the Shapiro-Wilk W test for only the untransformed radionuclides. The results of the Shapiro-Wilk W test and the normal-quantile plots indicate it is appropriate to use the *t*-test on the untransformed data.

Table 20. Results of the Shapiro-Wilk W test for radionuclides.

Analyte	Shapiro-Wilk Coefficient	*p*-value	Non-Normal
^{241}Am	0.9670	0.8554	No
^{242}Cm	0.9951	0.9942	No
^{244}Cm	0.8620	0.2356	No
^{137}Cs	0.8876	0.3452	No
^{3}H	0.7639	0.0399	Yes
^{129}I	0.9449	0.7011	No
^{63}Ni	0.8447	0.1782	No
^{237}Np	0.9410	0.6729	No
^{238}Pu	0.9045	0.4350	No
^{239}Pu	0.9048	0.4372	No
^{241}Pu	0.8340	0.1419	No
Total Sr	0.9222	0.5444	No
^{99}Tc	0.9726	0.8576	No
^{234}U	0.9113	0.4755	No
^{235}U	0.9622	0.8235	No

5.7 Verification of Standard Deviation Assumption

The SAP associated with this project assumed a standard deviation of 10% of the AL to estimate the sample size necessary to achieve the desired α and β. The ratio (standard deviation)/(AL) was measured for each detected analyte.

The next highest ratio was 0.08 for ^{125}Sb. This implies that the standard deviation assumption was met for each analyte with the exception of ^{226}Ra. Therefore, the chosen levels of α and β were, in fact, conservative estimates of true levels of α and β achieved using the data sets for this analysis for each of the analytes except for ^{226}Ra.

Table 21 provides the complete list of standard deviation to AL comparisons for detected organic and inorganic analytes. Analytes for which no AL exists were excluded from the table. Likewise, Table 22 provides the comparison of standard deviation to performance assessment modeled inventory values for detected radionuclides.

Table 21. Summary of comparison of standard deviation to action level for detected organic and inorganic analytes.

Analyte	Standard Deviation	Action Level	Percentage
Organics	µg/L	µg/L	%
2-Butanone	1.27E+01	1.60E+05	0.01
n-Nitrosodimethylamine	4.00E–01	7.30E+01	0.55
Pyridine	8.50E+00	4.30E+03	0.20
Metals	µg/L	µg/L	%
Aluminum	6.46E+01	3.10E+06	0.02
Barium	3.77E–01	8.30E+04	0.00
Cadmium	3.87E–01	6.10E+02	0.06
Chromium	2.96E+00	9.00E+02	0.33
Copper	1.73E+00	6.00E+05	0.00
Iron	3.04E+02	1.70E+06	0.18
Lead	1.39E+00	4.00E+03	0.03
Manganese	2.79E+00	4.90E+05	0.00
Mercury	7.42E+00	1.60E+02	4.64
Nickel	1.73E+00	4.40E+05	0.00
Silver	8.94E+00	3.00E+03	0.30
Zinc	1.99E+00	1.70E+06	0.00
Anions	mg/L	mg/L	%
Fluoride	3.8E–01	7.70E+02	0.00

Table 22. Summary of comparison of standard deviation to inventory value for detected radionuclides.

Analyte	Standard Deviation	Inventory[a]	Percentage
Radionuclides	pCi/L	pCi/L	%
^{241}Am	1.44E+04	3.60E+07	0.04
^{14}C	5.46E+00	9.90E+07	0.00
^{242}Cm	8.20E+01	3.67E+04	0.22
^{244}Cm	8.07E+02	3.21E+06	0.03
^{137}Cs	2.79E+07	1.15E+11	0.02
^{3}H	1.22E+05	1.61E+07	0.76
^{129}I	3.27E+02	7.44E+04	0.44
^{63}Ni	5.07E+04	8.70E+07	0.06
^{237}Np	5.89E+02	3.43E+05	0.17
^{238}Pu	3.87E+05	5.70E+08	0.07
^{239}Pu	1.24E+05	7.05E+07	0.18
^{241}Pu	3.48E+04	4.24E+08	0.01
^{125}Sb	1.37E+05	1.49E+06	8.26
Total Sr	1.84E+08	8.15E+10	0.23
^{99}Tc	5.58E+02	2.99E+07	0.00
^{234}U	3.29E+02	2.52E+06	0.01
^{235}U	3.81E+01	1.20E+04	0.32
^{238}U	2.76E+01	1.64E+04	0.17

a. From the *Performance Assessment for the Tank Farm Facility at the Idaho National Engineering and Environmental Laboratory* (DOE-ID 2003b).

6. SUMMARY OF DATA ASSESSMENT

As discussed in the previous section, it was determined that the *t*-test may be appropriately applied to determine if the mean concentration of any constituent of concern exceeds its specified AL. The primary required assumption of the *t*-test is that the data are normal in distribution. The review of the data relative to this distribution assumption was performed in Section 5 and shows that the assumption was adequately met for all data except as noted in Section 5.

The DQOs for the study use a conservative statistic to estimate the population mean. Specifically, the decisions statements for the project specify, "*If* the true mean (as estimated by the 95% UCL of the sample mean) concentration of any hazardous constituent…" These decision statements allow a simple comparison of the 95% UCL of the mean to the AL to make decisions. The DQOs of the study also specify a desired rate for α of 5%. The confidence level for a UCL is equal to (1 – α)*100%. This means that 95% of all UCLs generated from all samples of size 5 will be less than the action limit if the mean concentration of the hazardous constituent in the tank is less than the AL. The 95% UCL can be thought of as a conservatively high estimate of the population mean. The comparison of the 95% UCL to the AL is a way of performing the *t*-test.

The UCL of the sample mean is calculated using Equation (5):

$$UCL = \bar{x} + t^{*}_{1-\alpha,df}\,\frac{s}{\sqrt{n}} \tag{5}$$

where

$\bar{x}$	=	sample mean.
$t^{*}_{1-\alpha,df}$	=	*t*-statistic for the confidence level, (1 – α)*100%, and degrees of freedom, *df*. In this case, the confidence is (1 – 0.05)*100% = 95% and the degrees of freedom are $n - 1 = 4$. From statistical tables, this corresponds to a value of 2.132 (or 2.776 for pH as explained below).
s	=	sample standard deviation.
n	=	number of samples taken.

The 95% LCL is also of importance to analyzing the pH. Because the pH has ALs for both high pH and low pH, it is necessary to determine if the pH is less than the LCL. Because both the LCL and the UCL are important, the *t*-value for the LCL and UCL will be determined with α/2 instead of α to ensure that the total probability of a false-positive decision error occurring is α rather than 2*α. The LCL is compared to a pH of 2 to ensure that the true mean is greater than 2 at the specified degree of confidence. The LCL is calculated using Equation (6):

$$LCL = \bar{x} - t^{*}_{1-\alpha/2,df}\,\frac{s}{\sqrt{n}} \tag{6}$$

where

$\overline{x}$ = sample mean.

$t^*_{1-\alpha/2,df}$ = t-statistic for degree of confidence, $(1 - \alpha)*100\%$, and degrees of freedom, df. In this case, the confidence is $(1 - 0.05)*100\% = 95\%$ and the degrees of freedom are $n - 1 = 4$. Because both the LCL and the UCL are being compared to an AL, $\alpha/2 = 0.025$ is used to determine the appropriate t-value. From statistical tables, this corresponds to a value of 2.776.

s = sample standard deviation.

n = number of samples taken.

Data were examined to determine if assumptions for using the *t*-test were met. Each constituent either clearly met the assumption of normality or was skewed in such a way that the data are biased against rejecting the null hypothesis that the AL is exceeded.

Table 23 contains the sample means, UCLs used to estimate the population mean, ALs, and decisions about whether or not the ALs may have been exceeded for each of the detected organic and inorganic constituents. Although analytical anomalies were encountered in the generation of the SVOC data, the data can be used to generate reasonable, conservative assumptions for worse-case data. Because the worse-case data still meet the ALs, the analytical data generated were considered adequate for use in this DQA. The detected compounds and reported concentrations utilized in this DQA are comparable to results from other analyses associated with closure of the TFF. Copper and mercury are the only RCRA-regulated metals that were transformed. All of the organic and inorganic constituents were present in the rinsate at concentrations that were statistically significantly less than their ALs (as demonstrated by the 95% UCL) or had too few measurements above the detection level to construct a meaningful UCL. All measurements for analytes that fell into the latter category were far below the action level (as discussed in Section 3). The data provide a high degree of confidence in making a decision that the decontamination efforts were successful in reducing concentrations of RCRA-regulated constituents below the ALs specified in the closure plan for Tank WM-183 (DOE-ID 2003a).

Table 24 contains pH data, including the sample means, LCLs, and UCLs used to estimate the population means, ALs, and decisions about whether or not either AL may have been exceeded. This statistical comparison confidently shows that pH levels did not exceed the ALs.

No specific regulatory thresholds relative to the activity (i.e., concentrations) exist for the radionuclides left in any one tank after decontamination. Rather, the total inventory of radionuclides remaining in all closed components of the TFF will be evaluated following completion of the TFF decontamination efforts. The performance assessment (DOE-ID 2003b) conducted to address the DOE Order 435.1 (2001) closure requirements provides an estimate of acceptable radionuclide concentrations in the liquids remaining in each tank following decontamination. While these modeled levels are not the basis for a decision such as continuing to clean a tank, the modeled values required to meet DOE closure standards can be compared with the levels achieved through decontamination efforts. Because of this, hypothesis testing is not required to make decisions concerning whether decontamination of Tank WM-183 may cease; however, hypothesis testing using the modeled value as the AL provides information on the decontamination effort for the radionuclides.

Table 23. Summary of post-decontamination concentrations of organic and inorganic constituents detected in the rinsate of Tank WM-183.

Constituent	Mean Concentration	95% UCL	Units	Action Level	Action Level Exceeded?
Organics					
2-Butanone	2.24E+01	3.45E+01	µg/L	1.6E+05	No
2-Butanone (ln (ln x) transformation)	1.98E+01	3.04E+01	µg/L	1.6E+05	No
n-Nitrosodimethylamine	1.8E+00	2.2E+00	µg/L	7.3E+01	No
Phenol[a]	6.3E+00	9.9E+00	µg/L	2.4E+06	No
Tri-n-butyl phosphate	1.12E+01	1.40E+01	µg/L	[b]	[b]
Undecanoic acid	3.54E+01	7.44E+01	µg/L	[c]	[c]
Metals					
Aluminum	2.65E+02	3.26E+02	µg/L	3.1E+06	No
Barium	1.38E+00	1.74E+00	µg/L	8.3E+04	No
Cadmium	1.50E+00	1.87E+00	µg/L	6.1E+02	No
Calcium	5.67E+01	6.29E+01	µg/L	[b]	[b]
Chromium	8.12E+00	1.09E+01	µg/L	9.0E+02	No
Copper	2.14E+00	3.79E+00	µg/L	6.0E+05	No
Copper (ln x transformation)	1.77E+00	3.24E+00	µg/L	6.0E+05	No
Iron	4.42E+02	7.32E+02	µg/L	1.7E+06	No
Manganese	9.96E+00	1.26E+01	µg/L	4.9E+05	No
Mercury	6.60E+01	7.31E+01	µg/L	1.6E+02	No
Mercury (e^x transformation)	7.02E+01	7.09E+01	µg/L	1.6E+02	No
Molybdenum	2.02E+01	3.00E+01	µg/L	[b]	[b]
Nickel	8.98E+00	1.06E+01	µg/L	4.4E+05	No
Potassium	4.88E+02	5.71E+03	µg/L	[b]	[b]
Silver	3.77E+01	4.63E+01	µg/L	3.0E+03	No
Sodium	4.69E+02	5.40E+02	µg/L	[b]	[b]
Zinc	1.75E+01	1.94E+01	µg/L	1.7E+06	No
Anions					
Chloride	7.30E+00	8.11E+00	mg/L	[b]	[b]
Fluoride	6.84E+00	7.21E+00	mg/L	7.7E+02	No
Nitrate	1.49E+02	1.69E+02	mg/L	[b]	[b]
Sulfate	2.29E+01	2.70E+01	mg/L	[b]	[b]

a. Phenol was initially detected in WM-183. An action level was calculated using the method described in the approved closure plan.

b. Action levels have not been proposed for these constituents as described in the approved closure plan. Toxicity data are not available.

c. An action level cannot be calculated. Toxicity data are not available. This chemical has been detected only in Tank WM-183.

Table 24. Summary of post-decontamination pH in the rinsate of Tank WM-183.

	Mean	95% LCL	95% UCL	Lower Action Level	Upper Action Level	Action Level Exceeded?
pH	2.4	2.3	2.4	2.0	12.5	No

Table 25 provides the UCLs for radionuclides and compares it with the performance assessment modeled inventory (DOE-ID 2003b). None of the radionuclides required transformation. Radionuclides that had two or more non-detects do not appear in the table, but are discussed in Section 3. None of these analytes approach the inventory levels. All of the radionuclides were present in the rinsate at an activity that was significantly less than the activity modeled in the performance assessment (DOE-ID 2003b). The data provide a high degree of confidence in deciding that the decontamination efforts were successful in reducing the activity of all other radionuclides to below those modeled in the performance assessment (DOE-ID 2003b).

Table 25. Summary of post-decontamination activities of radionuclides in the rinsate of Tank WM-183.

Constituent	Mean Concentration	95% UCL	Units	Inventory[a]	Inventory Exceeded?
^{241}Am	1.83E+05	1.97E+05	pCi/L	3.60E+07	No
^{242}Cm	2.33E+02	3.11E+02	pCi/L	3.67E+04	No
^{244}Cm	3.81E+03	4.58E+03	pCi/L	3.21E+06	No
^{137}Cs	7.59E+07	1.03E+08	pCi/L	1.15E+11	No
^{3}H	5.27E+05	6.43E+05	pCi/L	1.61E+07	No
^{129}I	1.22E+03	1.53E+03	pCi/L	7.44E+04	No
^{63}Ni	2.54E+05	3.02E+05	pCi/L	8.70E+07	No
^{237}Np	2.56E+03	3.12E+03	pCi/L	3.43E+05	No
^{238}Pu	6.63E+05	1.03E+06	pCi/L	5.70E+08	No
^{239}Pu	2.18E+05	3.37E+05	pCi/L	7.05E+07	No
^{241}Pu	1.01E+05	1.35E+05	pCi/L	4.24E+08	No
Total Sr	6.94E+08	8.70E+08	pCi/L	8.15E+10	No
^{99}Tc	1.10E+03	1.68E+03	pCi/L	2.99E+07	No
^{234}U	1.32E+03	1.64E+03	pCi/L	2.52E+06	No
^{235}U	7.01E+01	1.06E+02	pCi/L	1.20E+04	No

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Appendix A

Graphical Representation of Organic Data

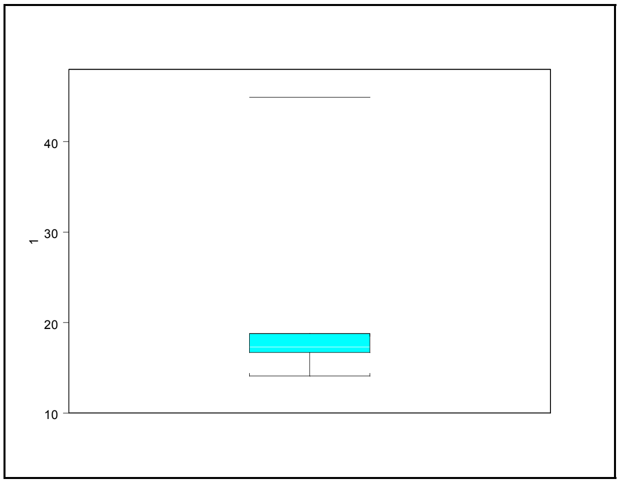


Figure A-1. Boxplot for 2-butanone data.

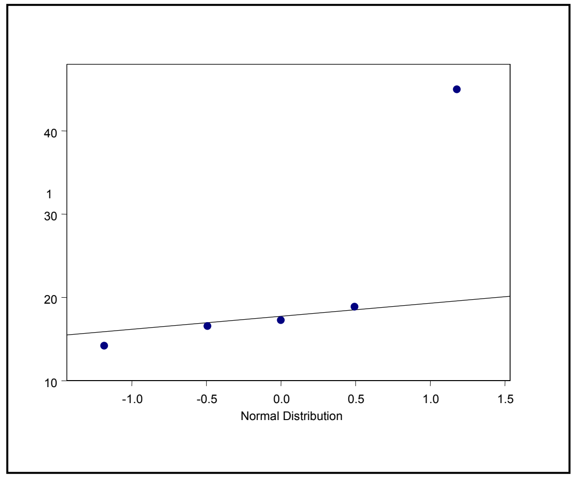


Figure A-2. Normal-quantile plot for 2-butanone data.

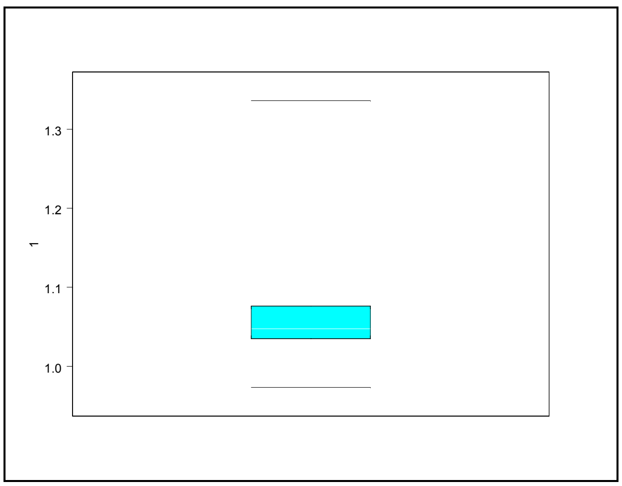


Figure A-3. Boxplot for ln (ln (2-butanone)) data.

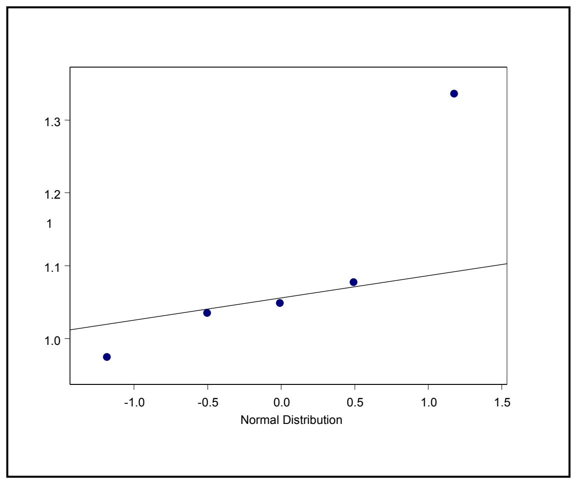


Figure A-4. Normal-quantile plot for ln (ln (2-butanone)) data.

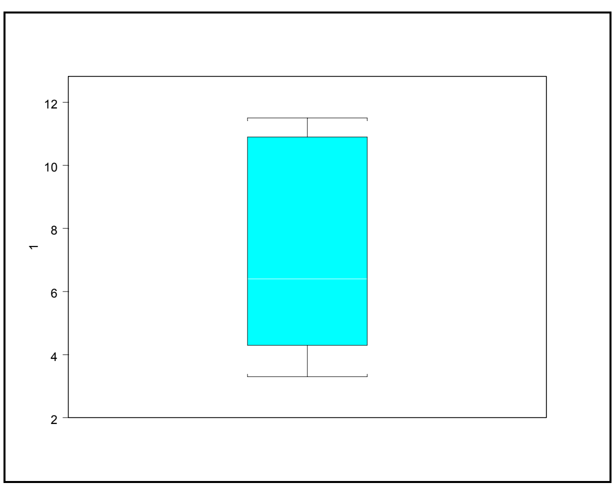


Figure A-5. Boxplot for 4-nitrophenol data.

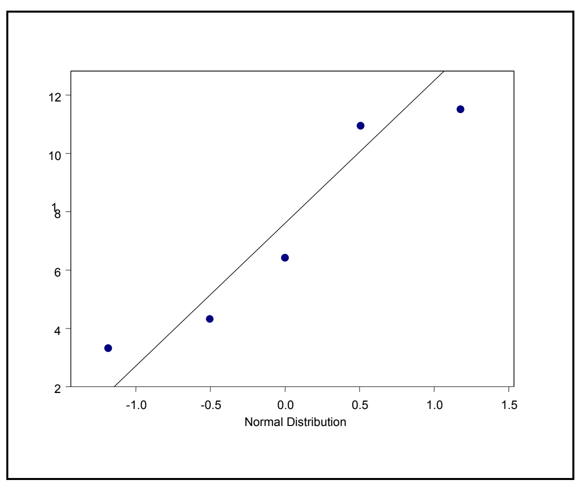


Figure A-6. Normal-quantile plot for 4-nitrophenol data.

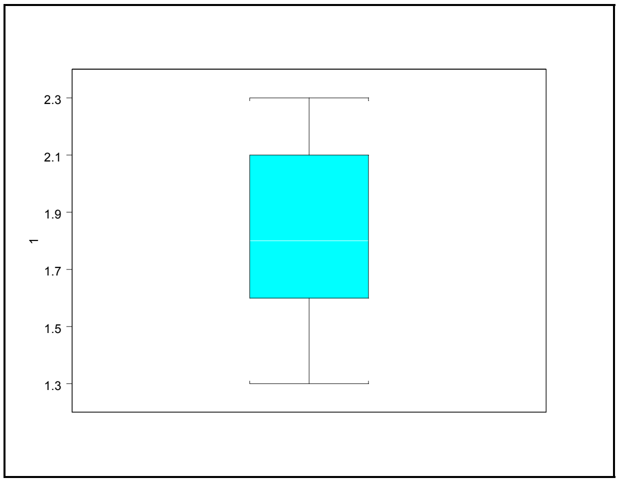


Figure A-7. Boxplot for n-Nitrosodimethylamine data.

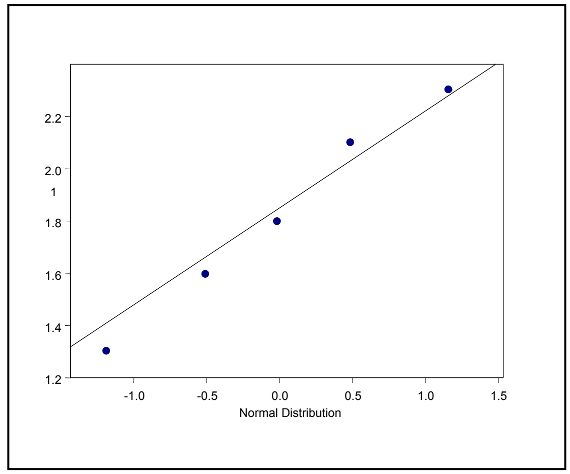


Figure A-8. Normal-quantile plot for n-Nitrosodimethylamine data.

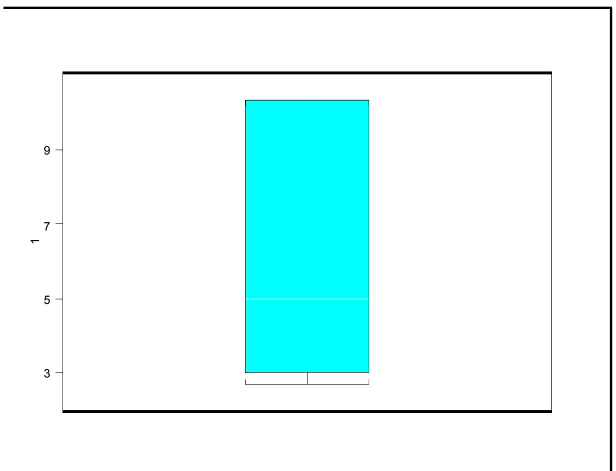


Figure A-9. Boxplot for phenol data.

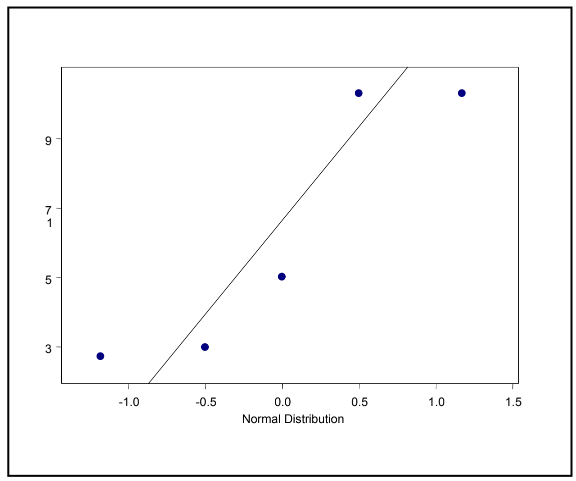


Figure A-10. Normal-quantile plot for phenol data.

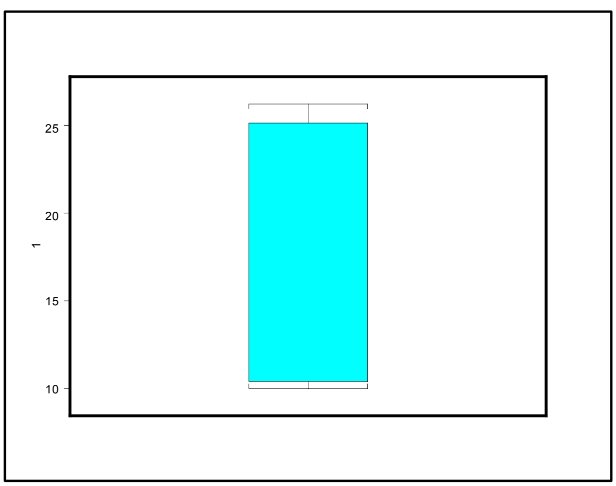


Figure A-11. Boxplot for pyridine data.

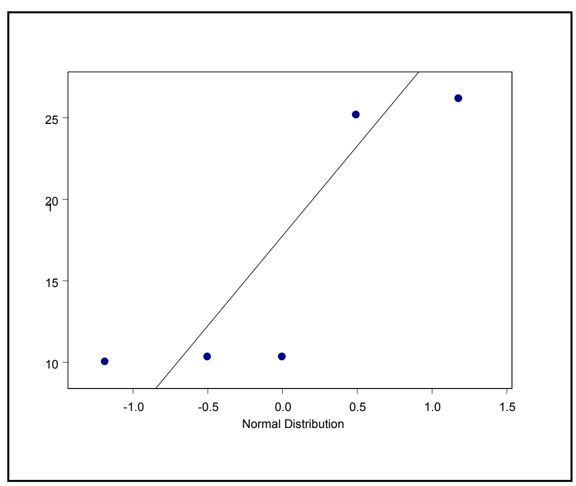


Figure A-12. Normal-quantile plot for pyridine data.

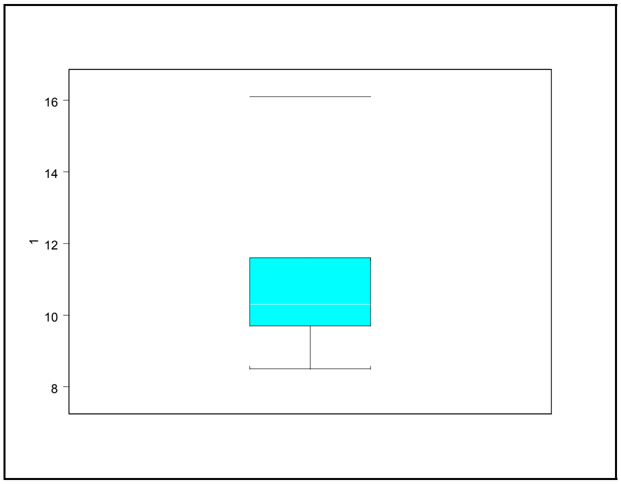


Figure A-13. Boxplot for tri-n-butyl phosphate data.

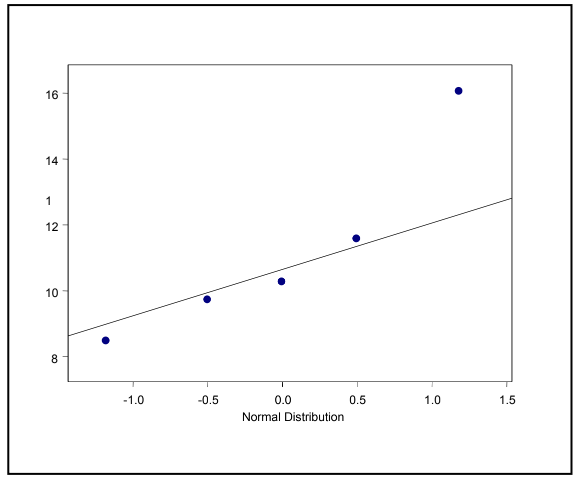


Figure A-14. Normal-quantile plot for tri-n-butyl phosphate data.

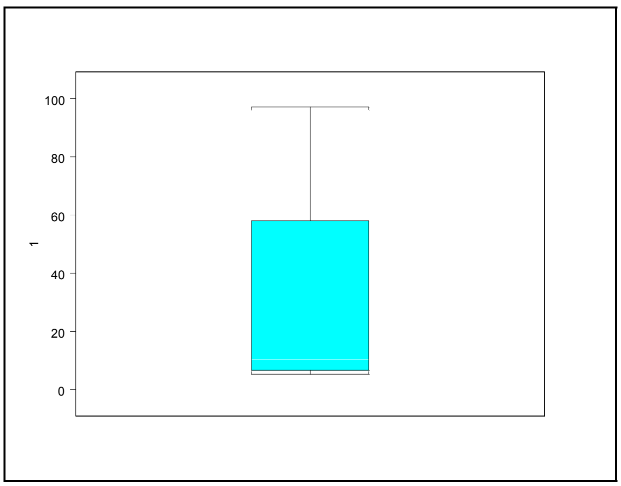


Figure A-15. Boxplot for undecanoic acid data.

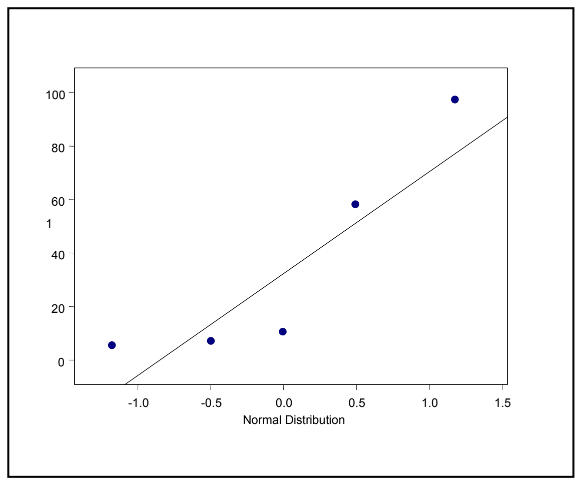
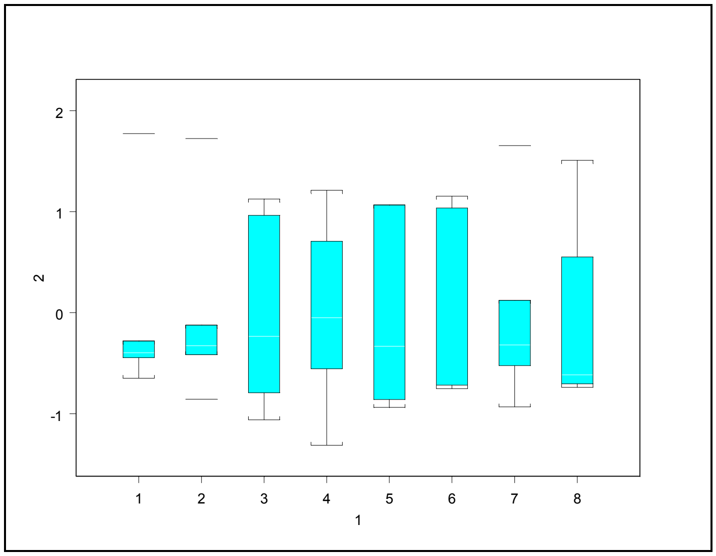


Figure A-16. Normal-quantile plot for undecanoic acid data.



These numbers correspond to the numbers on the grouped boxplot.

1 2-butanone
2 ln(ln(2-butanone))
3 4-nitrophenol
4 N-nitrosodimethylamine
5 Phenol
6 Pyridine
7 Tri-n-butyl phosphate
8 Undecanoic Acid

Figure A-17. Grouped boxplots of organic data. Data have been standardized so that distributions are directly comparable.

Appendix B

Graphical Representation of Metals Data

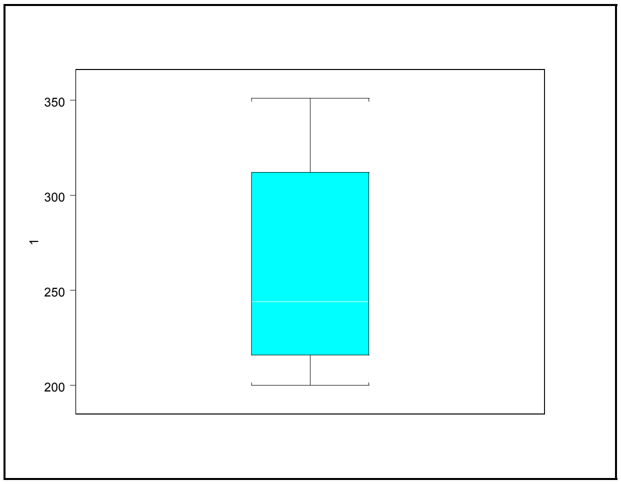


Figure B-1. Boxplot of aluminum data.

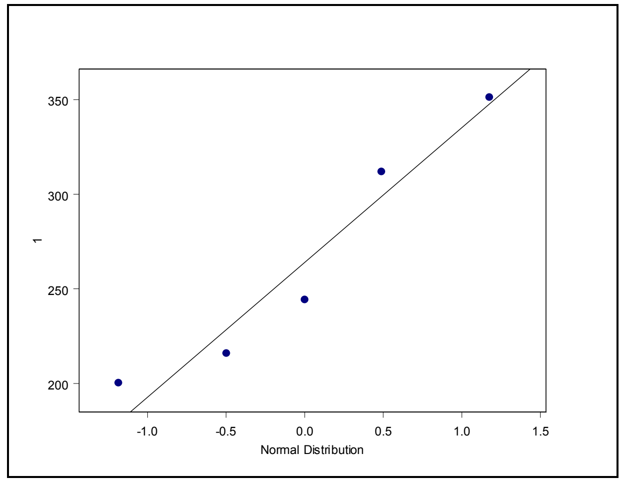


Figure B-2. Normal-quantile plot of aluminum data.

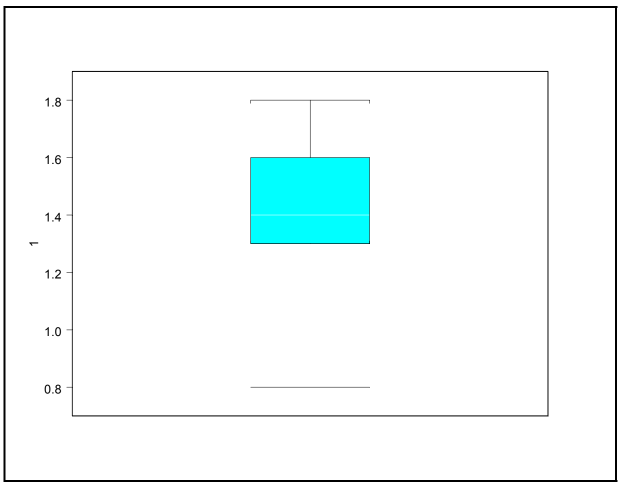


Figure B-3. Boxplot of barium data.

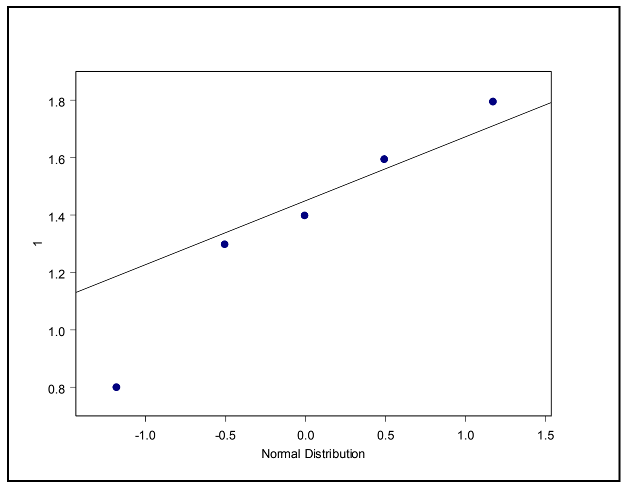


Figure B-4. Normal-quantile plot of barium data.

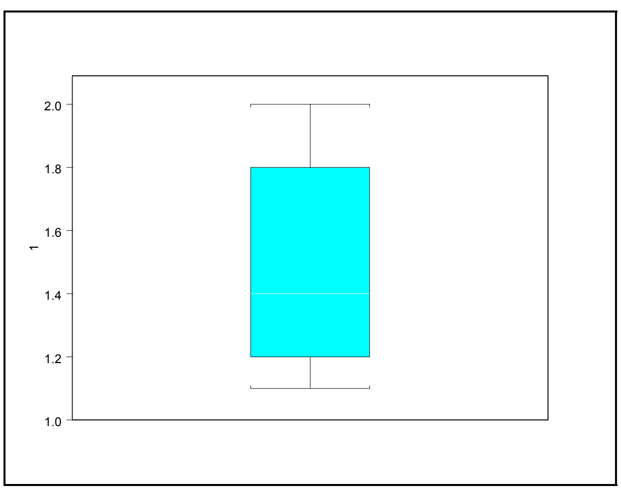


Figure B-5. Boxplot of cadmium data.

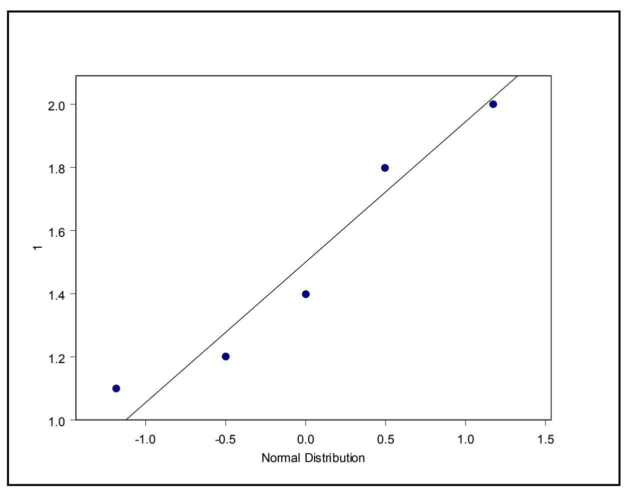


Figure B-6. Normal-quantile plot of cadmium data.

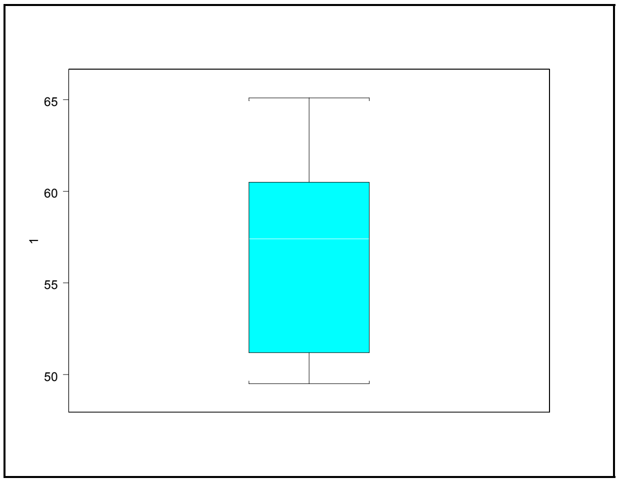


Figure B-7. Boxplot of calcium data.

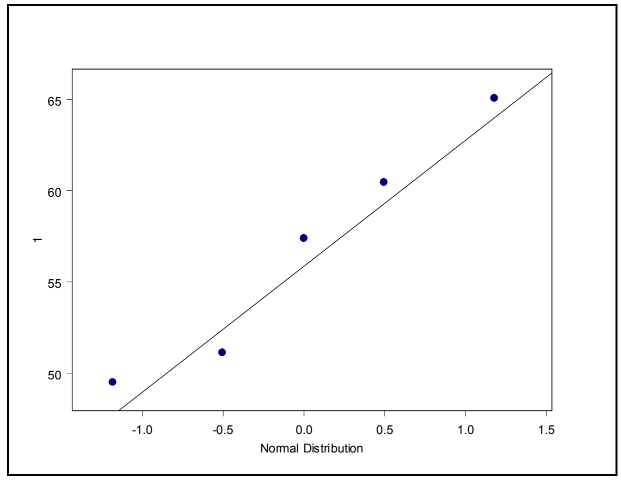


Figure B-8. Normal-quantile plot of calcium data.

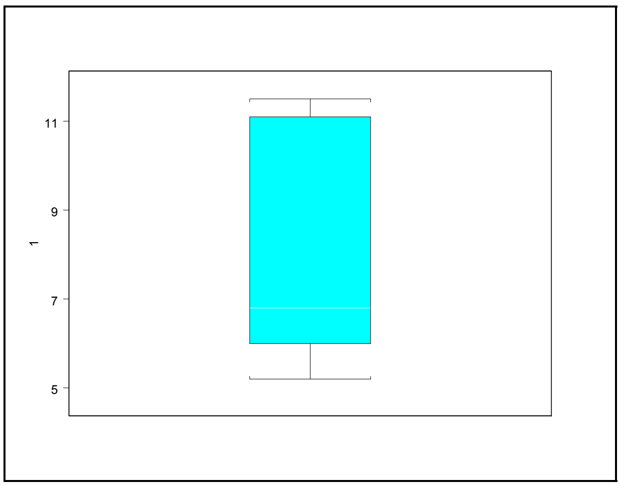


Figure B-9. Boxplot of chromium data.

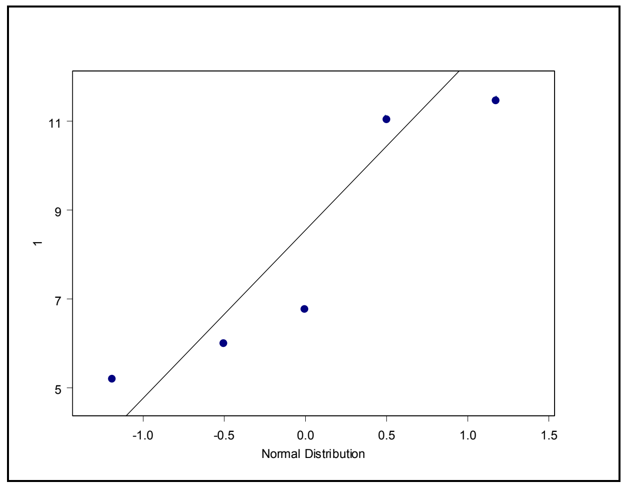


Figure B-10. Normal-quantile plot of chromium data.

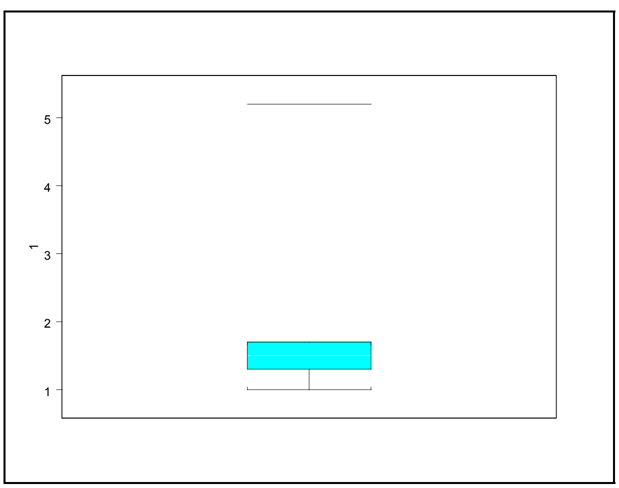


Figure B-11. Boxplot of copper data.

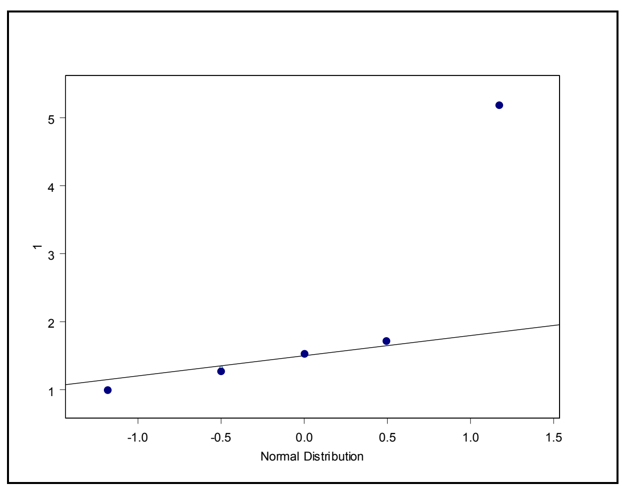


Figure B-12. Normal-quantile plot of copper data.

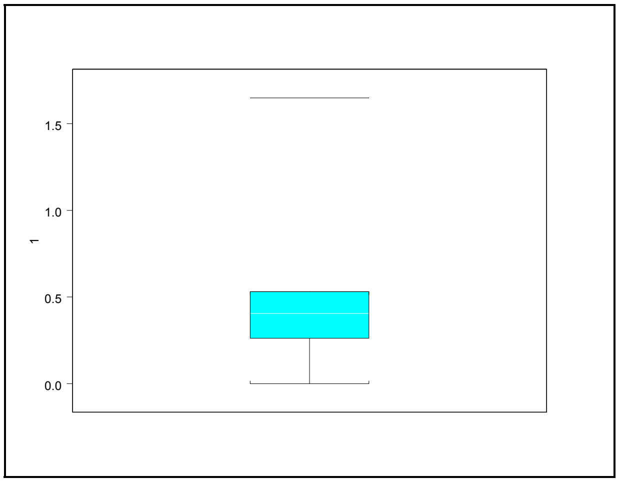


Figure B-13. Boxplot of copper data (ln *x* transformation).

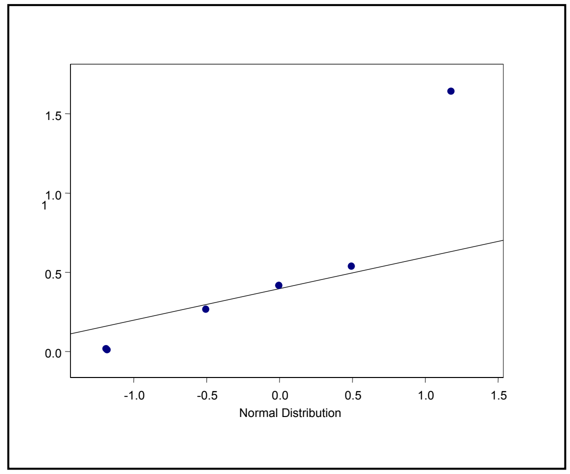


Figure B-14. Normal-quantile plot of copper data (ln *x* transformation).

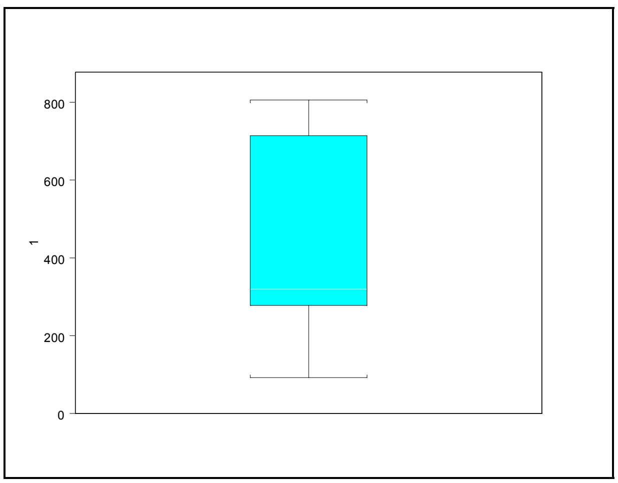


Figure B-15. Boxplot of iron data.

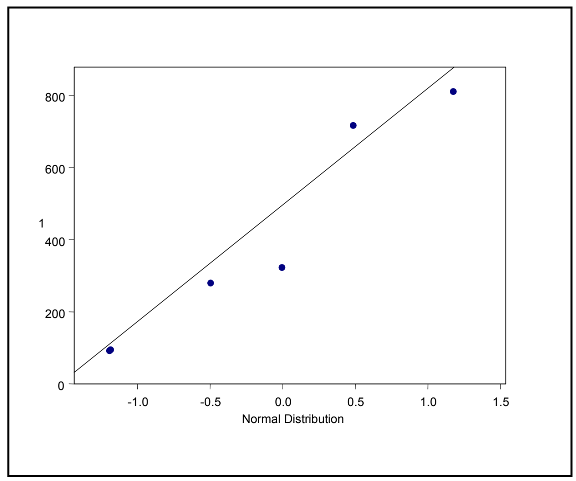


Figure B-16. Normal-quantile plot of iron data.

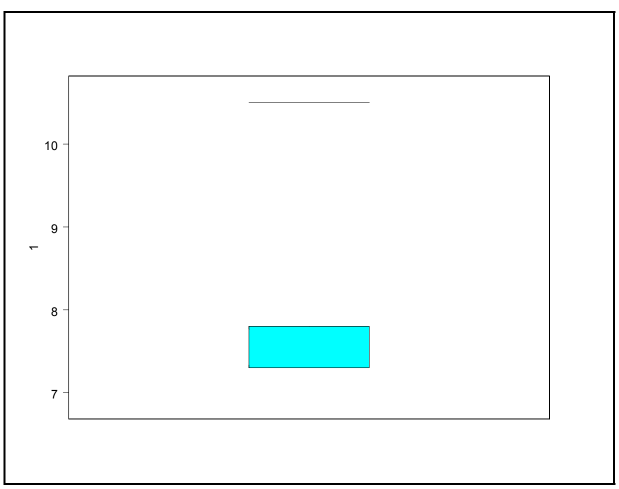


Figure B-17. Boxplot of lead data.

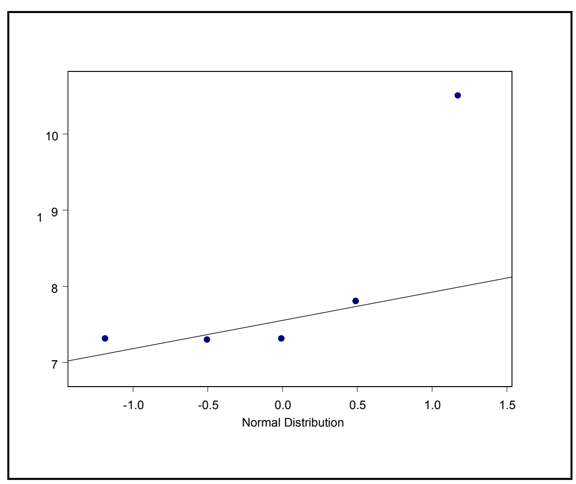


Figure B-18. Normal-quantile plot of lead data.

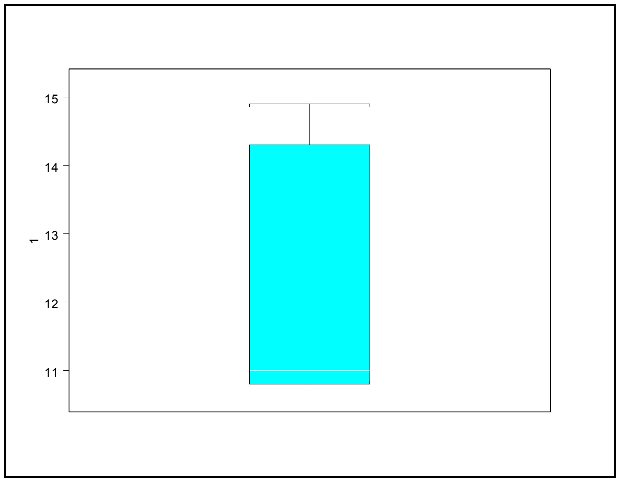


Figure B-19. Boxplot of magnesium data.

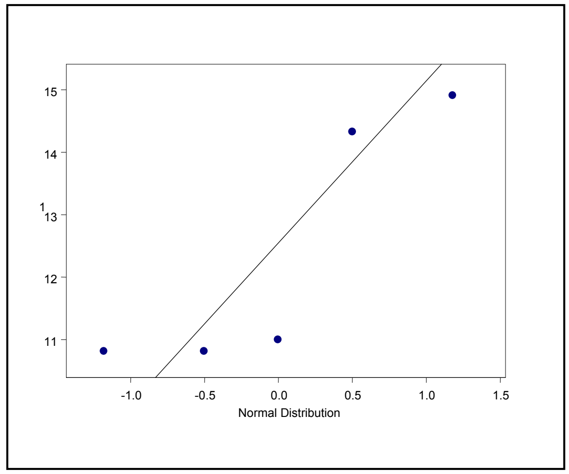


Figure B-20. Normal-quantile plot of magnesium data.

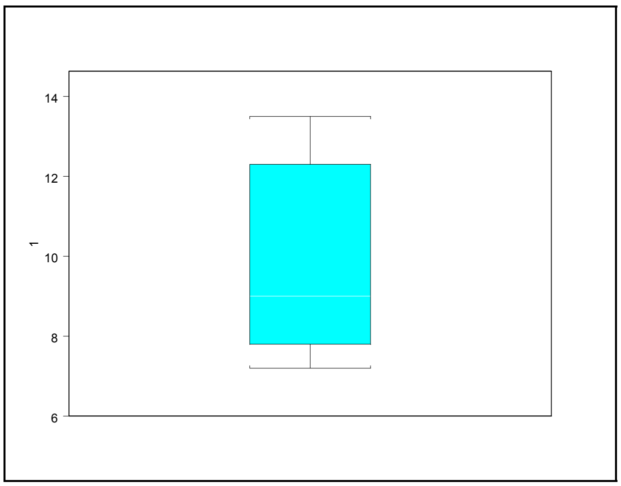


Figure B-21. Boxplot of manganese data.

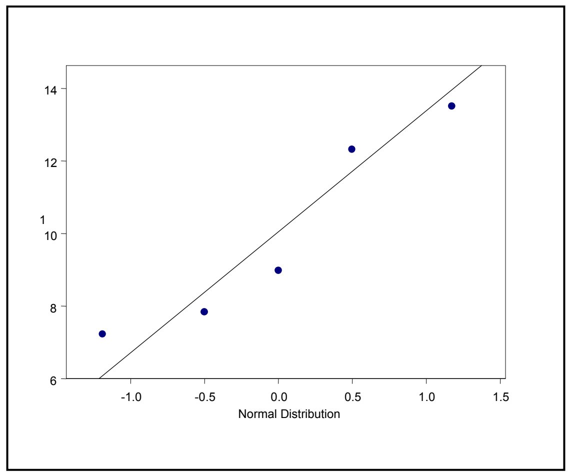


Figure B-22. Normal-quantile plot of manganese data.

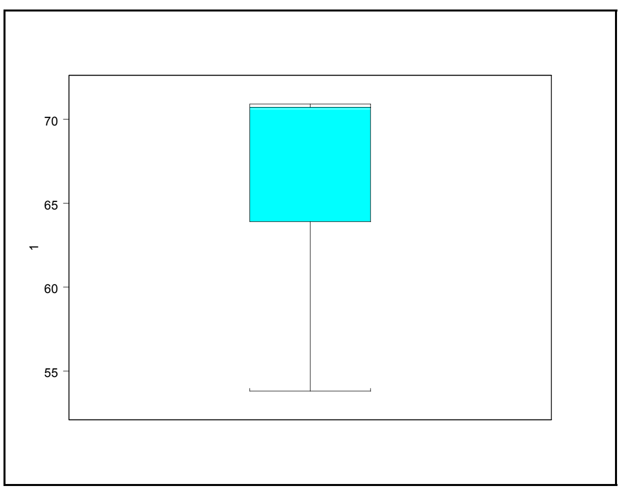


Figure B-23. Boxplot of mercury data.

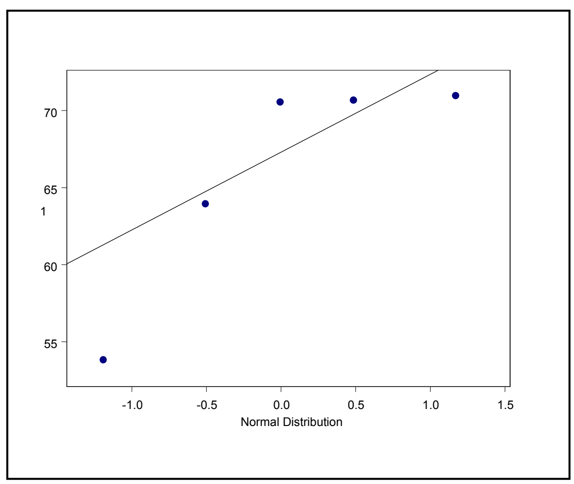


Figure B-24. Normal-quantile plot of mercury data.

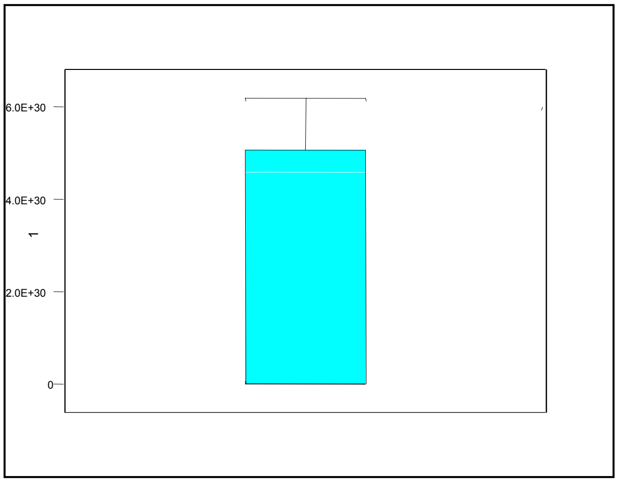


Figure B-25. Boxplot of $e^{(mercury)}$ data.

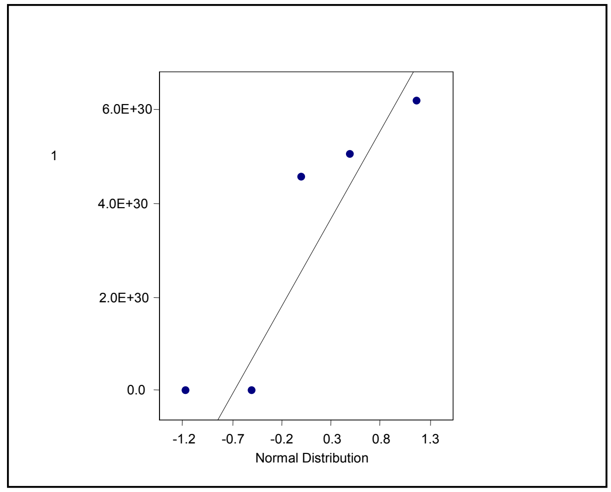


Figure B-26. Normal-quantile plot of $e^{(mercury)}$ data.

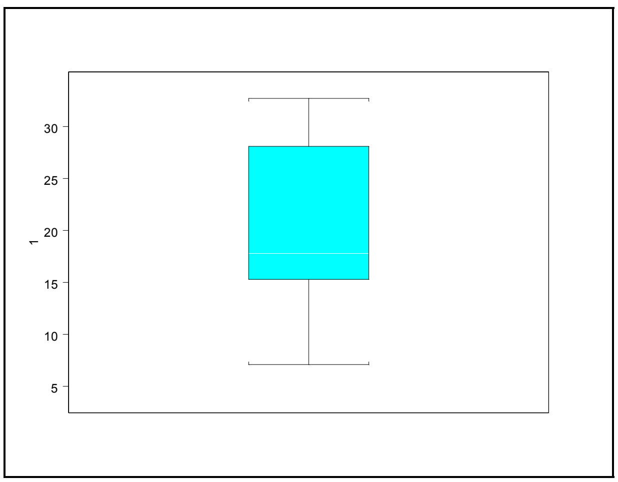


Figure B-27. Boxplot of molybdenum data.

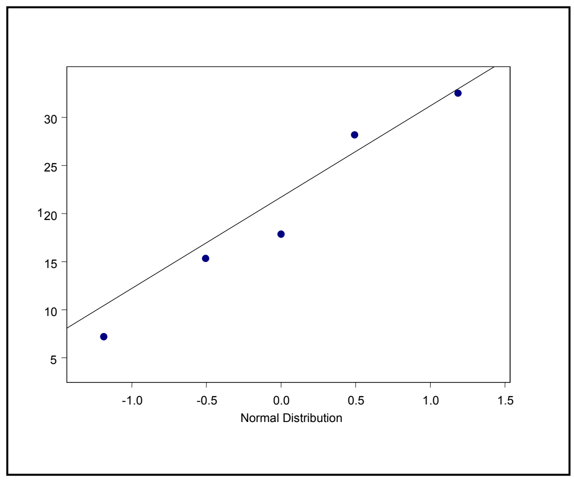


Figure B-28. Normal-quantile plot of molybdenum data.

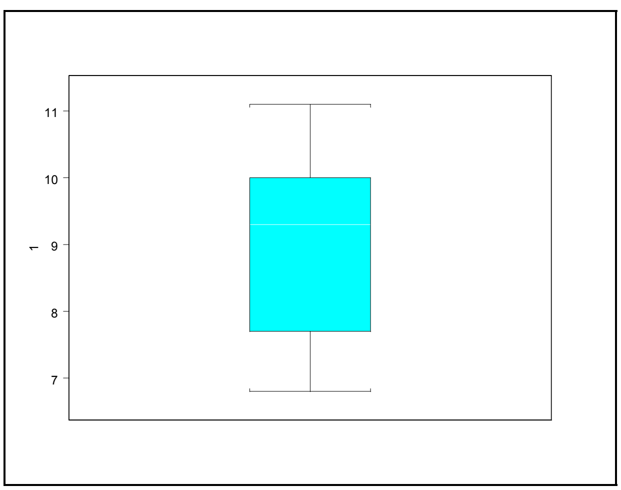


Figure B-29. Boxplot of nickel data.

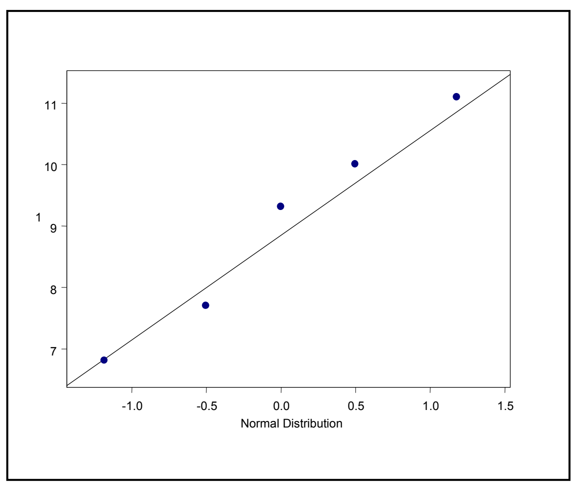


Figure B-30. Normal-quantile plot of nickel data.

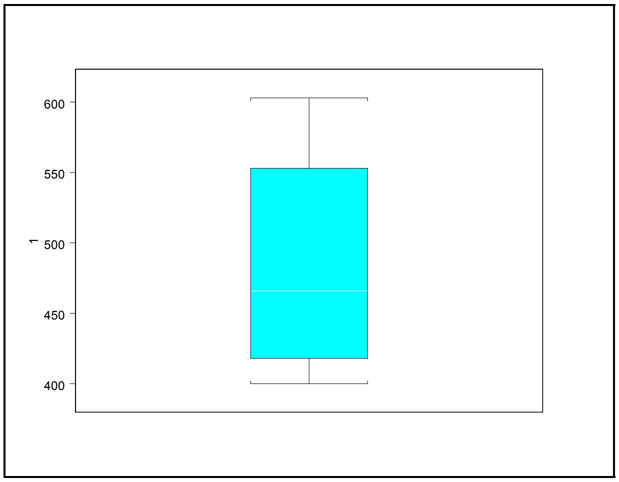


Figure B-31. Boxplot of potassium data.

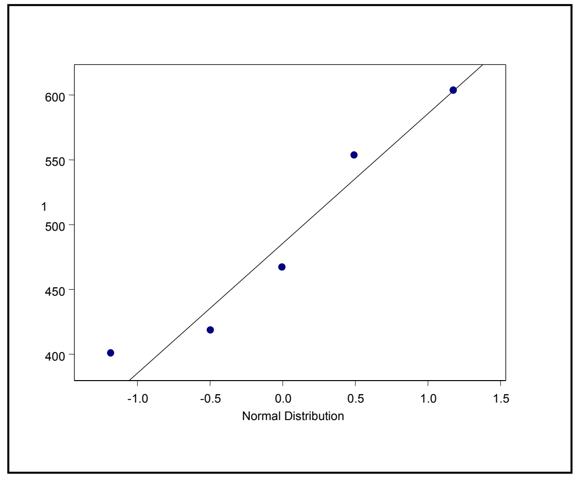


Figure B-32. Normal-quantile plot of potassium data.

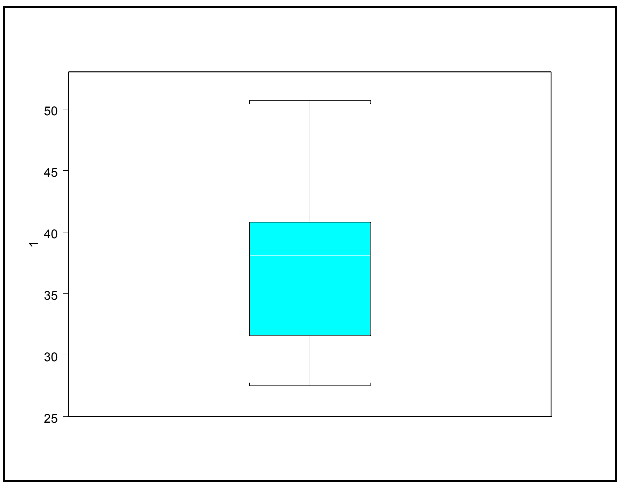


Figure B-33. Boxplot of silver data.

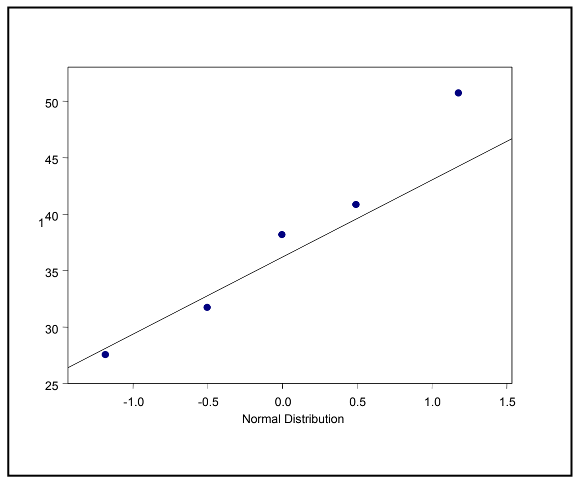


Figure B-34. Normal-quantile plot of silver data.

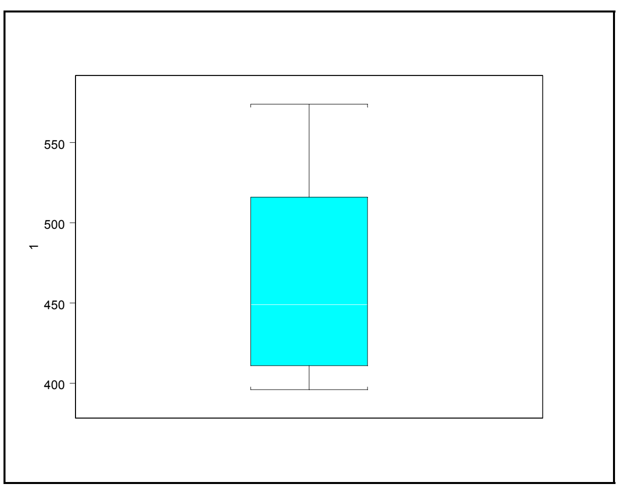


Figure B-35. Boxplot of sodium data.

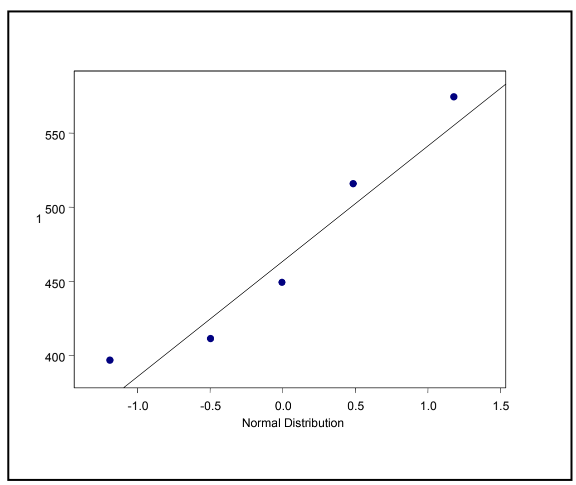


Figure B-36. Normal-quantile plot of sodium data.

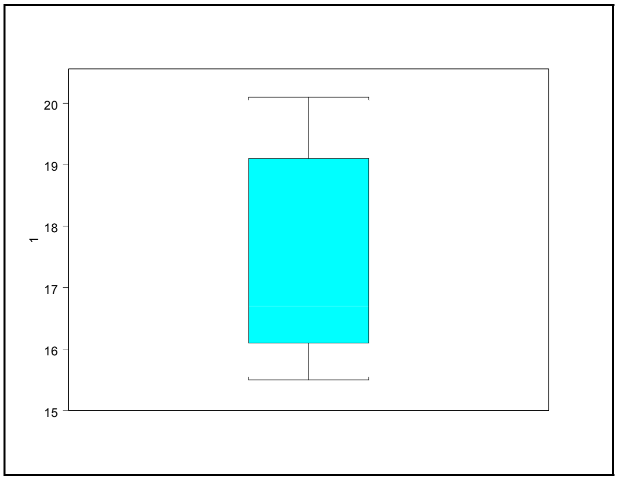


Figure B-37. Boxplot of zinc data.

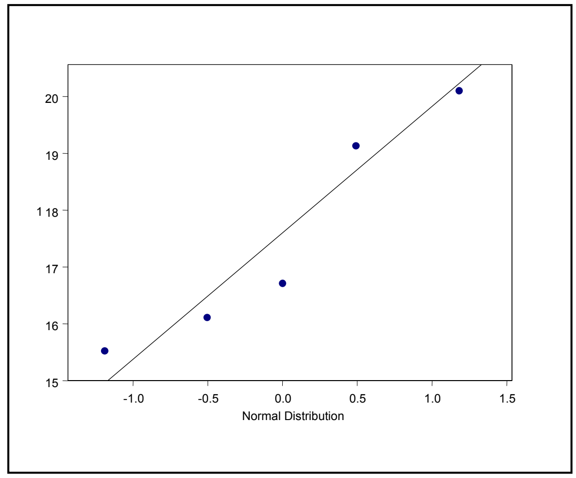
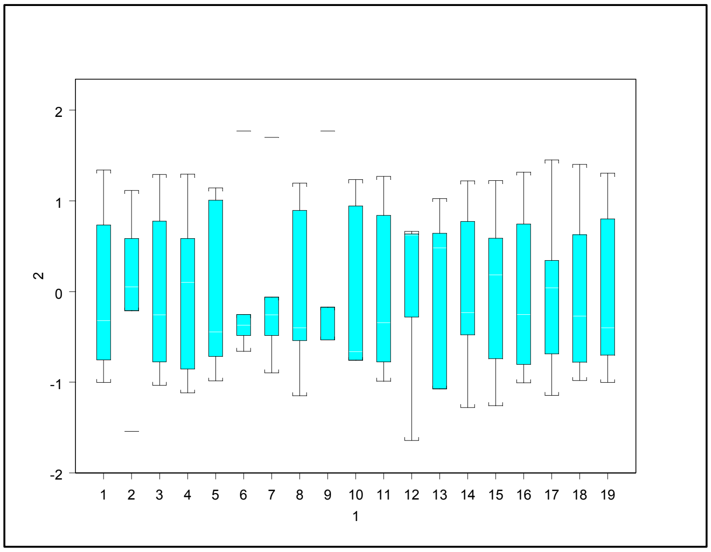


Figure B-38. Normal-quantile plot of zinc data.



These numbers correspond to the numbers on the grouped boxplot.

1	Aluminum
2	Barium
3	Cadmium
4	Calcium
5	Chromium
6	Copper
7	ln(Copper)
8	Iron
9	Lead
10	Magnesium
11	Manganese
12	Mercury
13	exp(Mercury)
14	Molybdenum
15	Nickel
16	Potassium
17	Silver
18	Sodium
19	Zinc

Figure B-39. Grouped boxplots of inorganic data. Data have been standardized so that distributions are directly comparable.

Appendix C

Graphical Representation of Anion Data

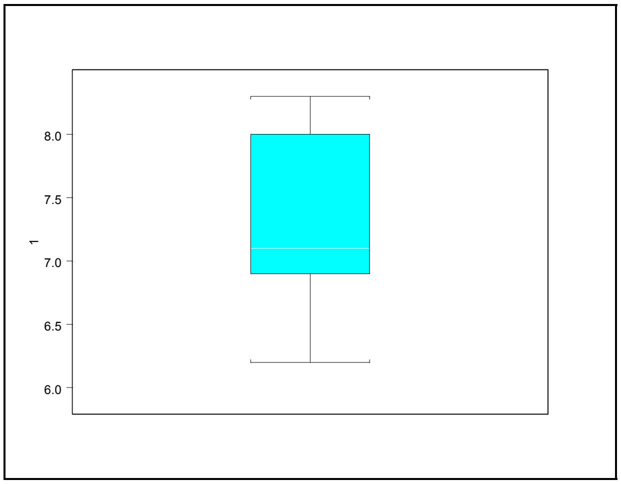


Figure C-1. Boxplot for chloride data.

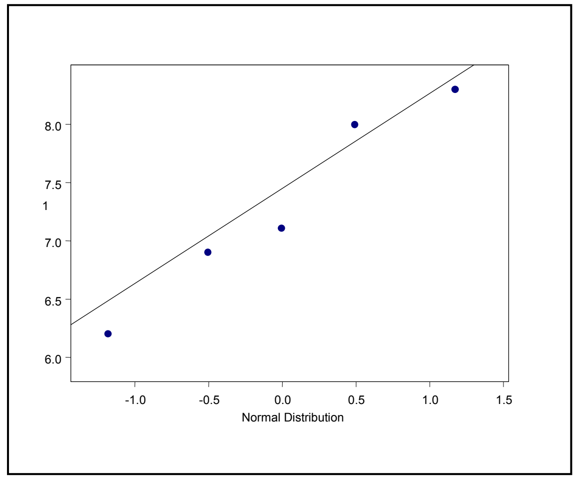


Figure C-2. Normal-quantile plot for chloride data.

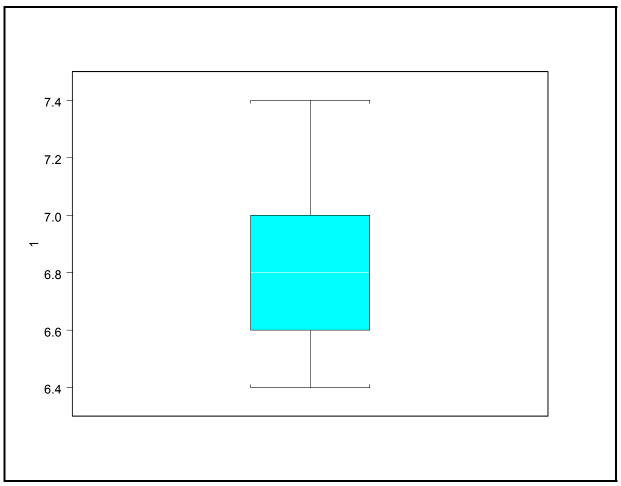


Figure C-3. Boxplot for fluoride data.

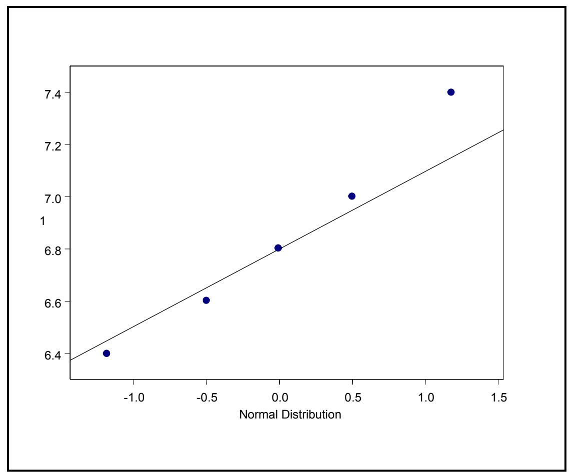


Figure C-4. Normal-quantile plot for fluoride data.

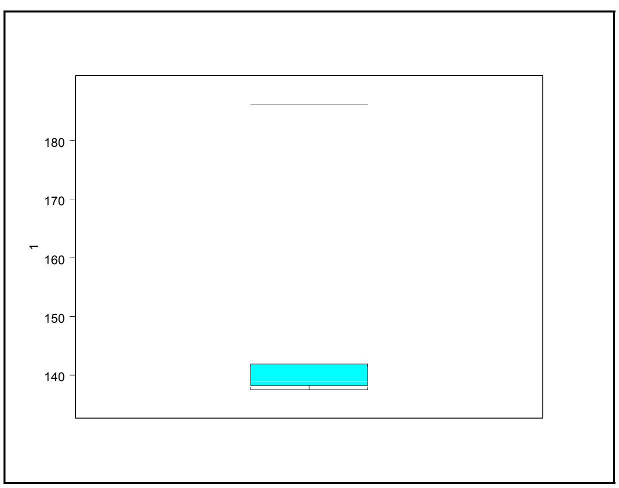


Figure C-5. Boxplot for nitrate data.

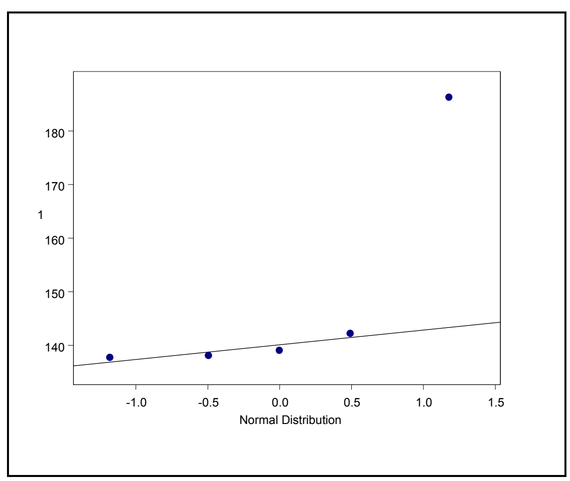


Figure C-6. Normal-quantile plot for nitrate data.

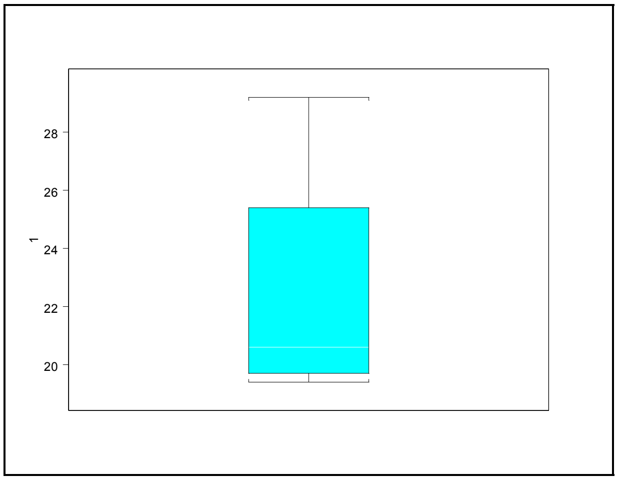


Figure C-7. Boxplot for sulfate data.

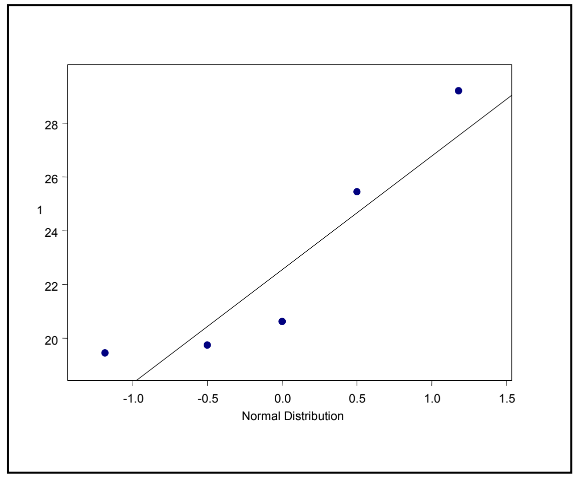
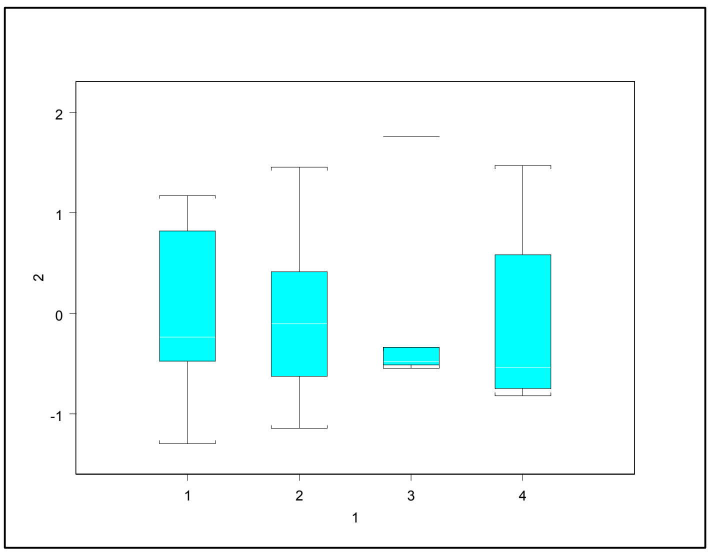


Figure C-8. Normal-quantile plot for sulfate data.



These numbers correspond to the numbers on the grouped boxplot.

1 Chloride
2 Fluoride
3 Nitrate
4 Sulfate

Figure C-9. Grouped boxplots of anion data. Data have been standardized so that distributions are directly comparable.

Appendix D

Graphical Representation of pH Data

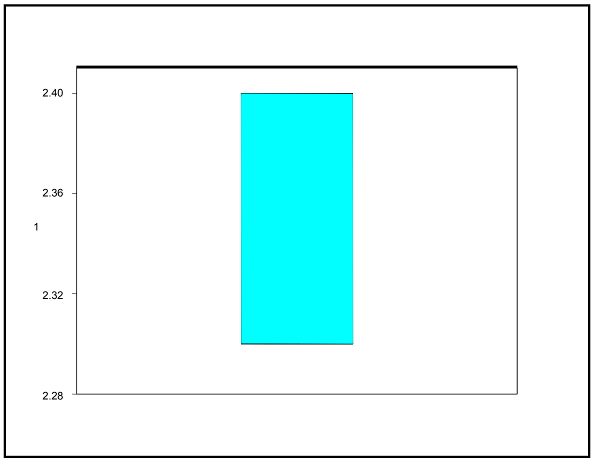


Figure D-1. Boxplot for pH data.

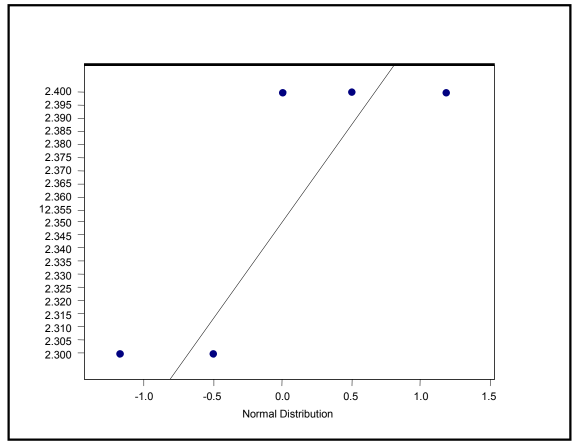


Figure D-2. Normal-quantile plot for pH data.

Appendix E

Graphical Representation of Radionuclide Data

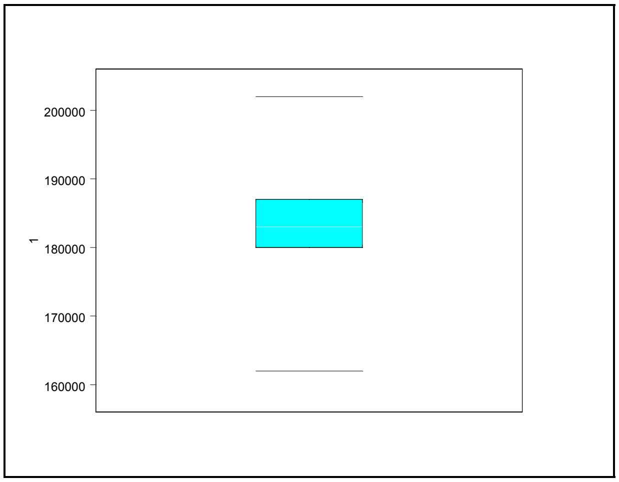


Figure E-1. Boxplot for ^{241}Am data.

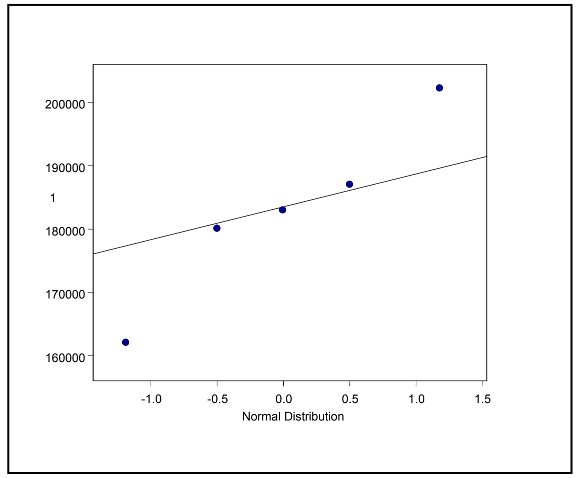


Figure E-2. Normal-quantile plot for ^{241}Am data.

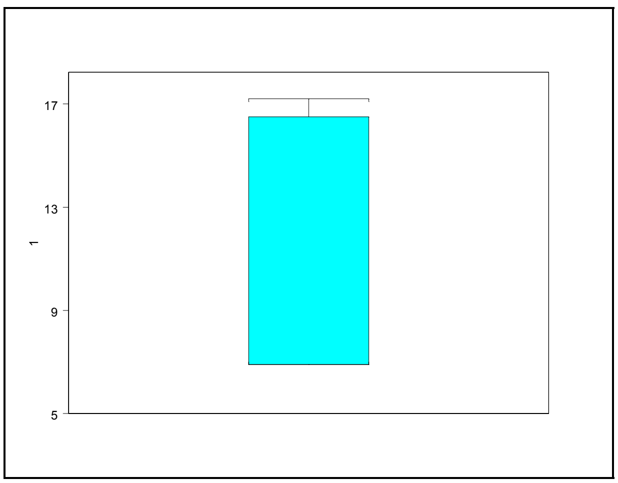


Figure E-3. Boxplot for ^{14}C data.

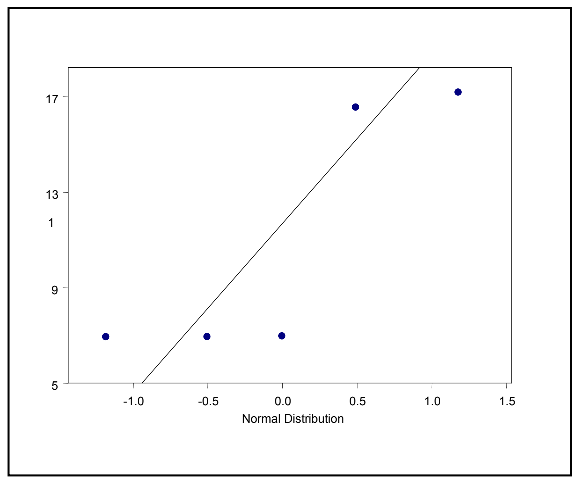


Figure E-4. Normal-quantile plot for ^{14}C data.

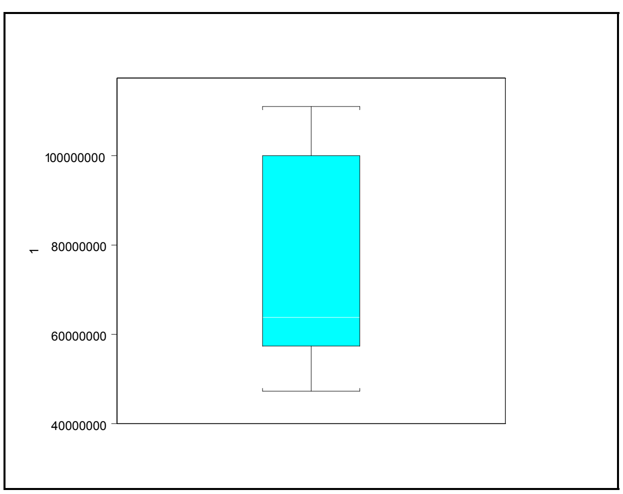


Figure E-5. Boxplot for ^{137}Cs data.

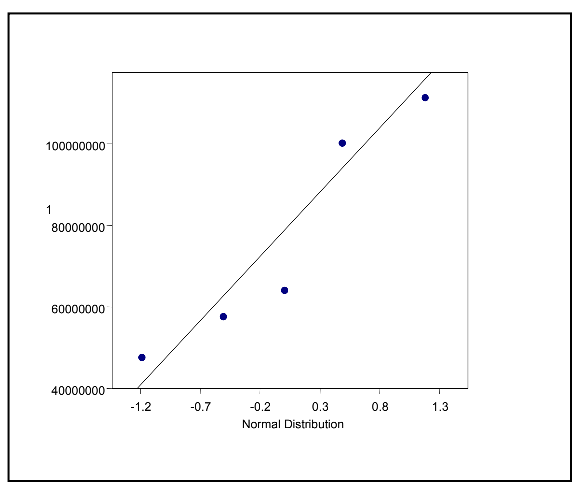


Figure E-6. Normal-quantile plot for ^{137}Cs data.

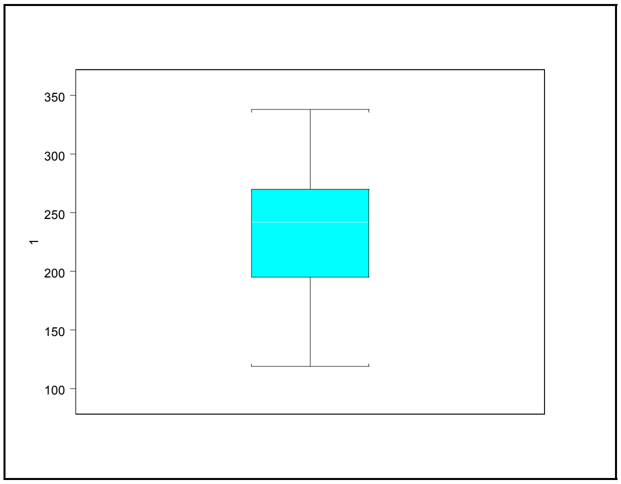


Figure E-7. Boxplot for ^{242}Cm data.

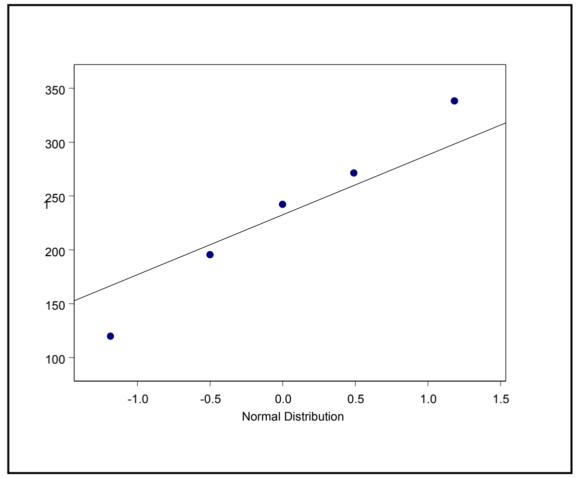


Figure E-8. Normal-quantile plot for ^{242}Cm data.

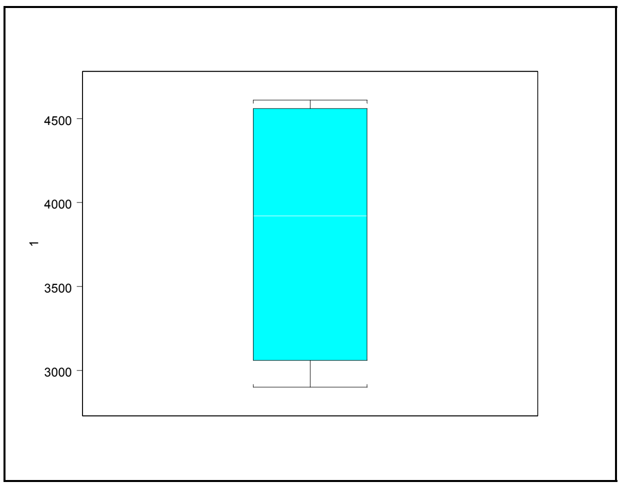


Figure E-9. Boxplot for ^{244}Cm data.

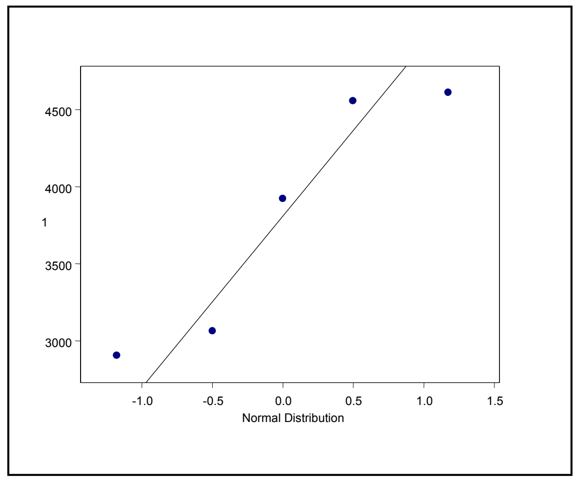


Figure E-10. Normal-quantile plot for ^{244}Cm data.

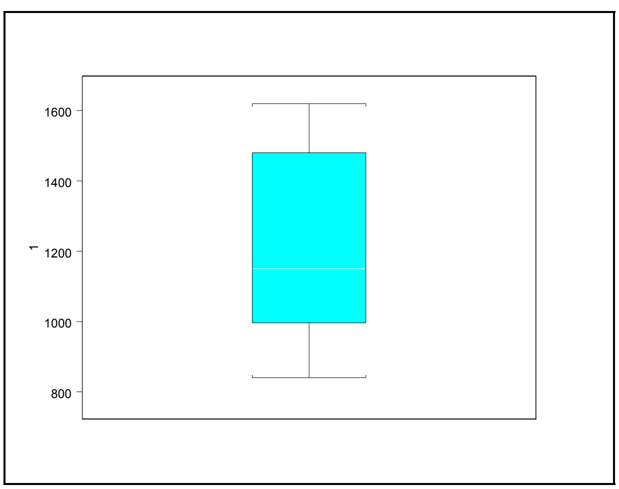


Figure E-11. Boxplot for ^{129}I data.

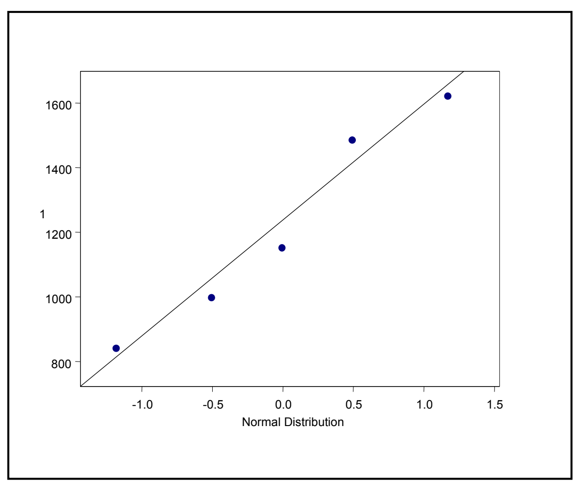


Figure E-12. Normal-quantile plot for ^{129}I data.

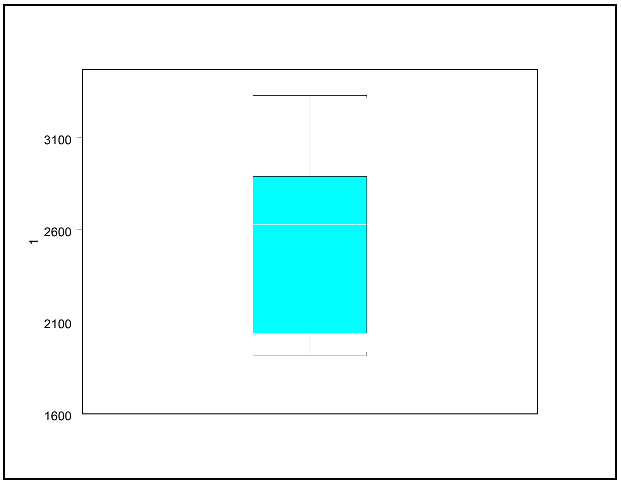


Figure E-13. Boxplot for ^{237}Np data.

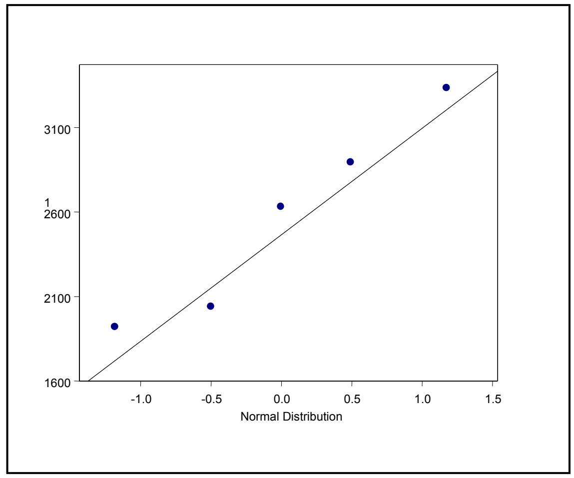


Figure E-14. Normal-quantile plot for ^{237}Np data.

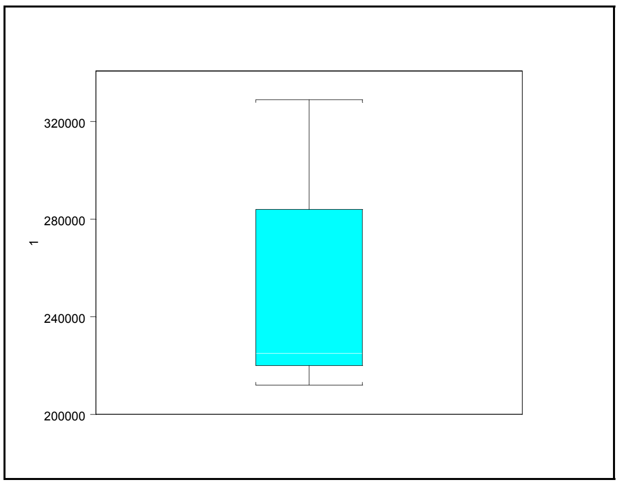


Figure E-15. Boxplot for ^{63}Ni data.

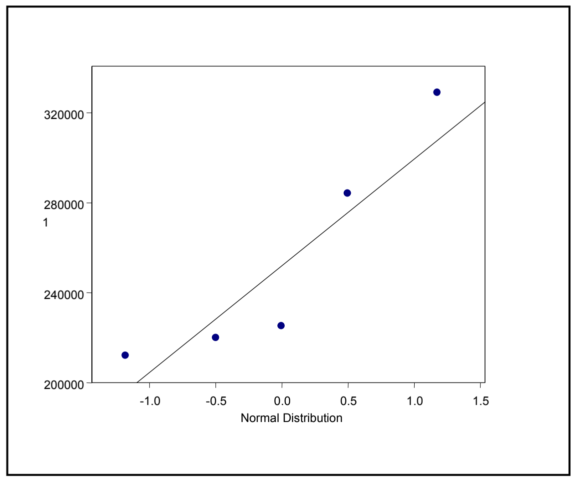


Figure E-16. Normal-quantile plot for ^{63}Ni data.

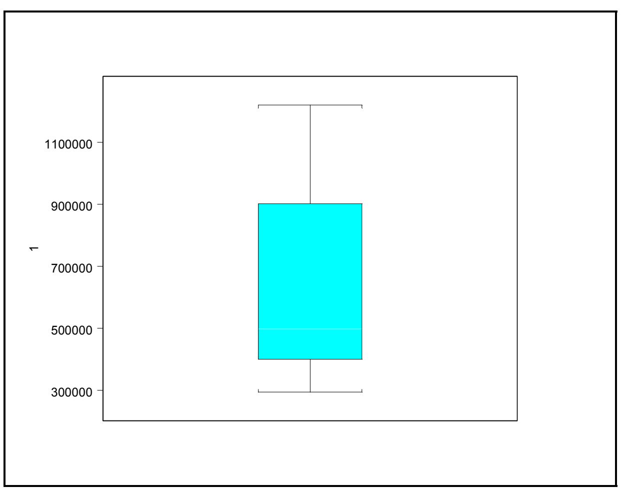


Figure E-17. Boxplot for ^{238}Pu data.

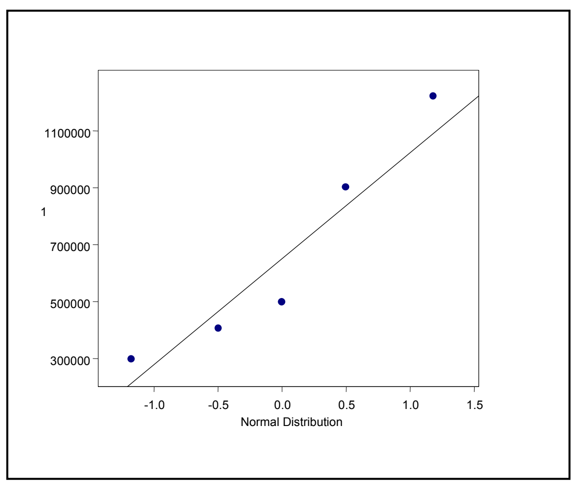


Figure E-18. Normal-quantile plot for ^{238}Pu data.

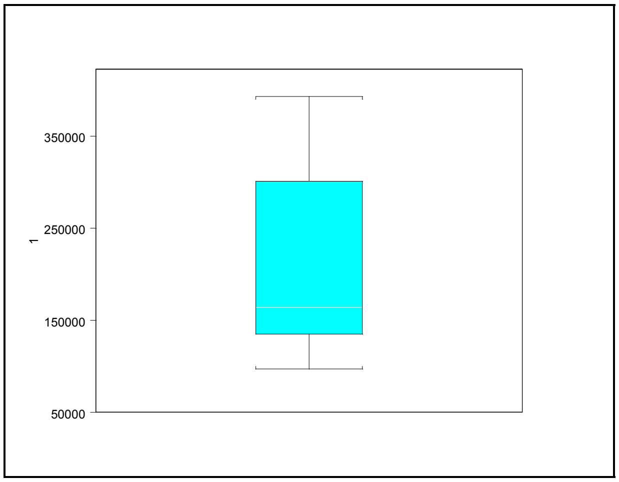


Figure E-19. Boxplot for ^{239}Pu data.

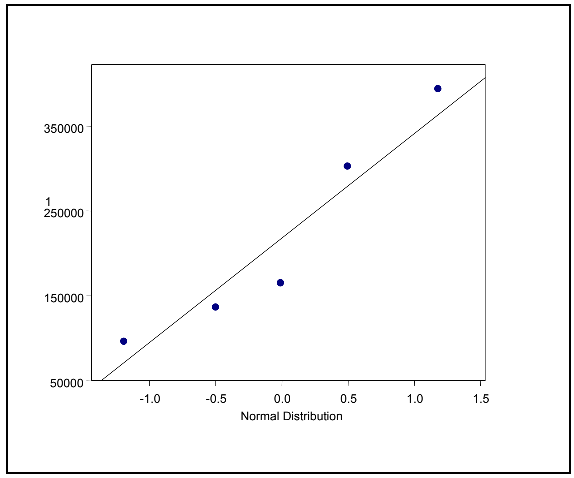


Figure E-20. Normal-quantile plot for ^{239}Pu data.

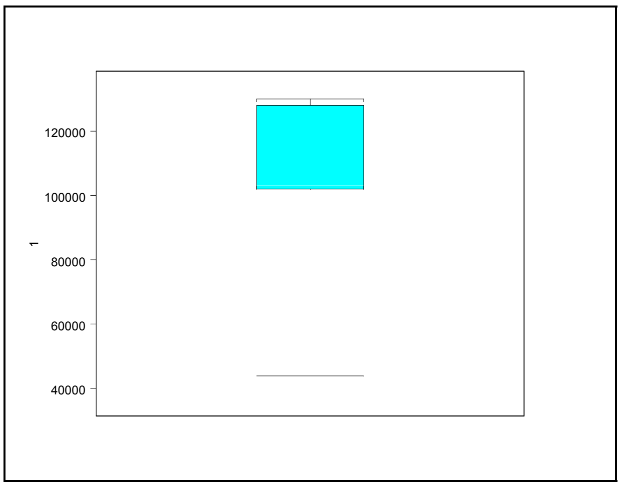


Figure E-21. Boxplot for ^{241}Pu data.

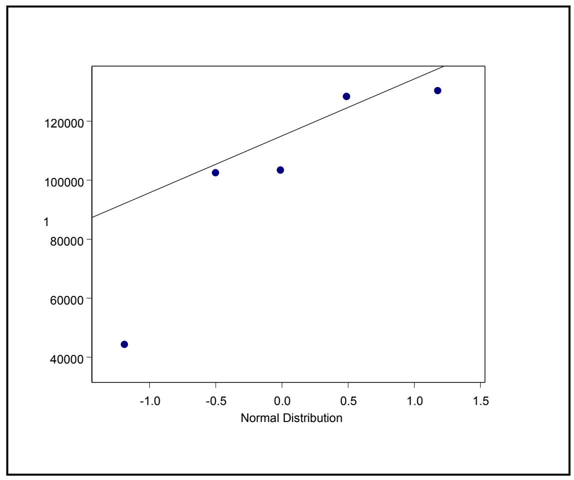


Figure E-22. Normal-quantile plot for ^{241}Pu data.

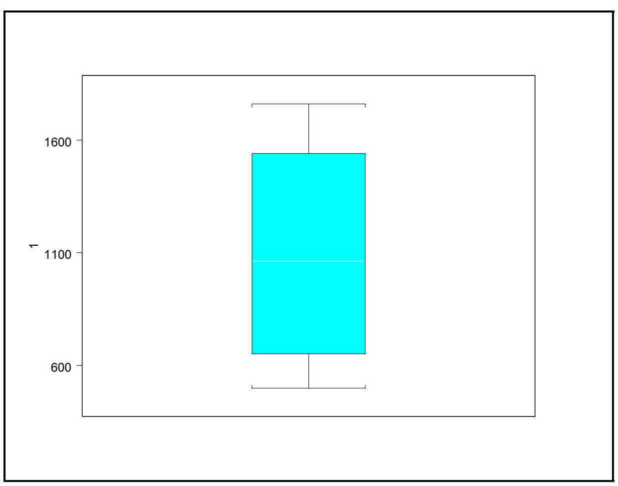


Figure E-23. Boxplot for ^{99}Tc data.

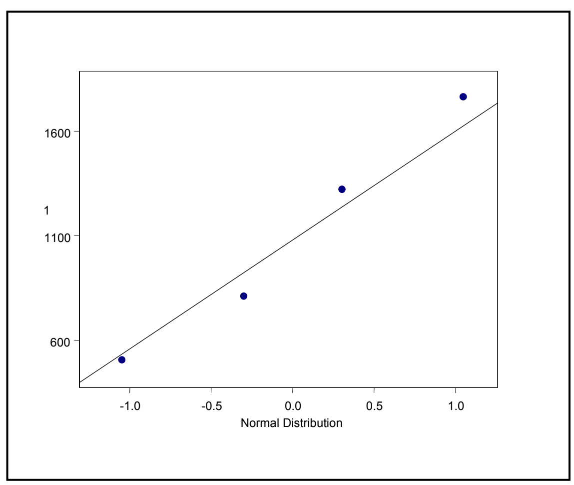


Figure E-24. Normal-quantile plot for ^{99}Tc data.

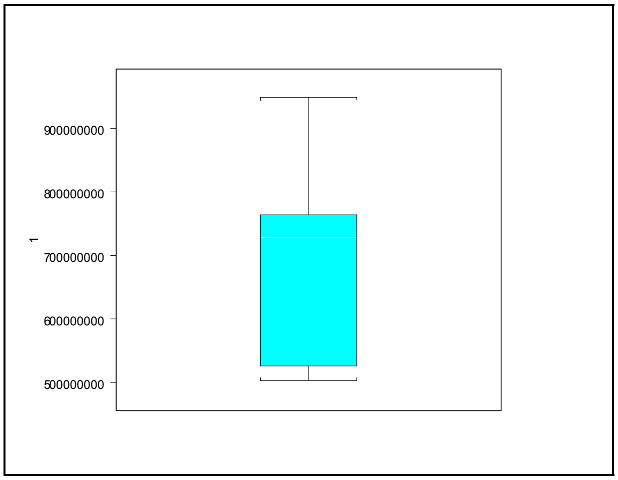


Figure E-25. Boxplot for total Sr data.

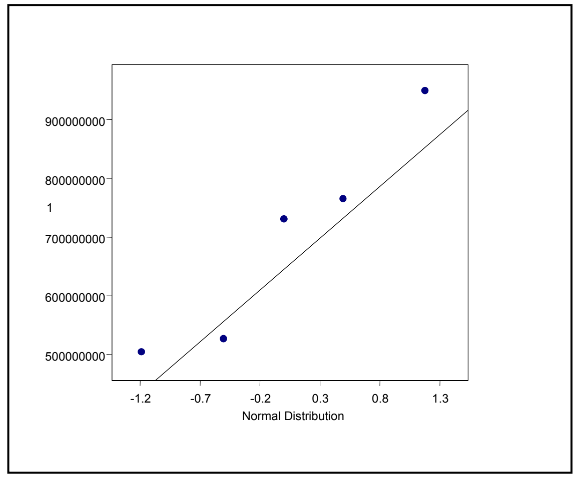


Figure E-26. Normal-quantile plot for total Sr data.

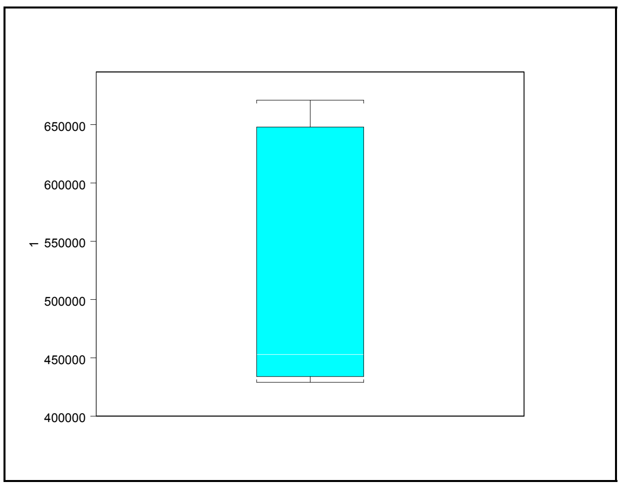


Figure E-27. Boxplot for ^{3}H data.

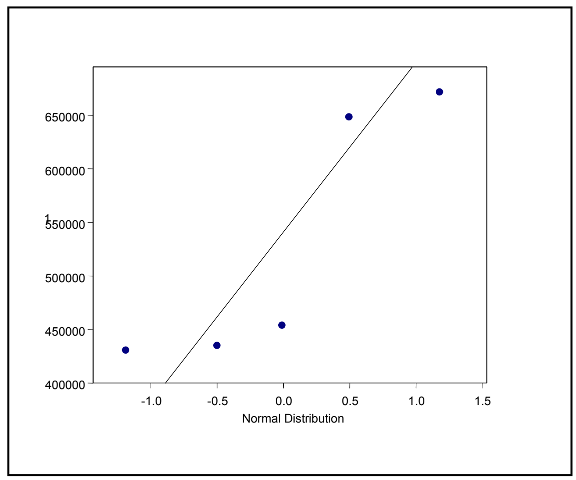


Figure E-28. Normal-quantile plot for ^{3}H data.

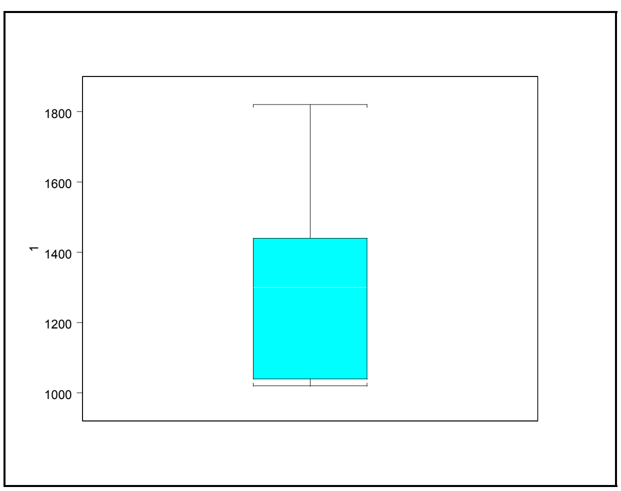


Figure E-29. Boxplot for ^{234}U data.

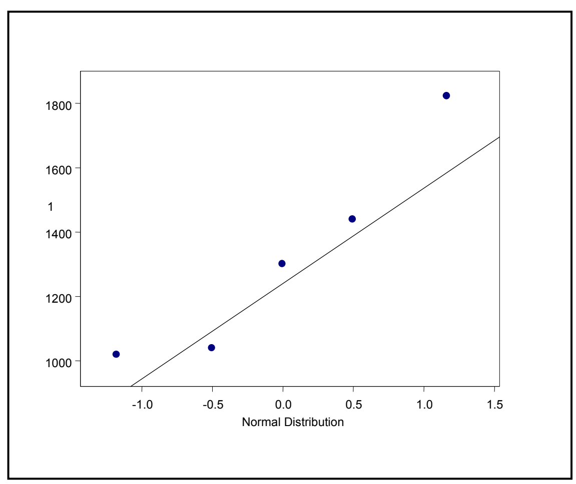


Figure E-30. Normal-quantile plot for ^{234}U data.

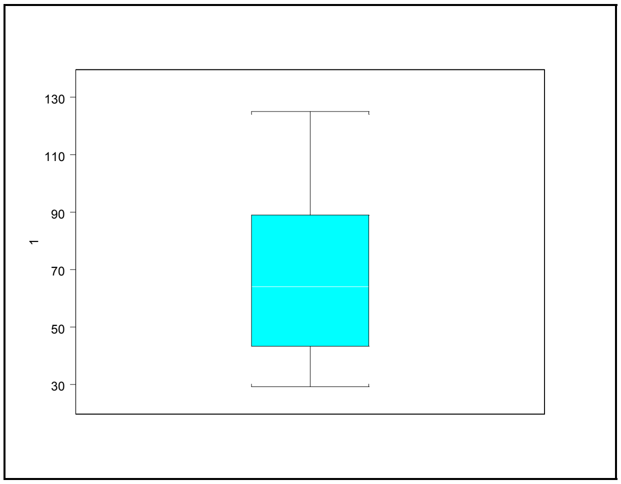


Figure E-31. Boxplot for log of ^{235}U data.

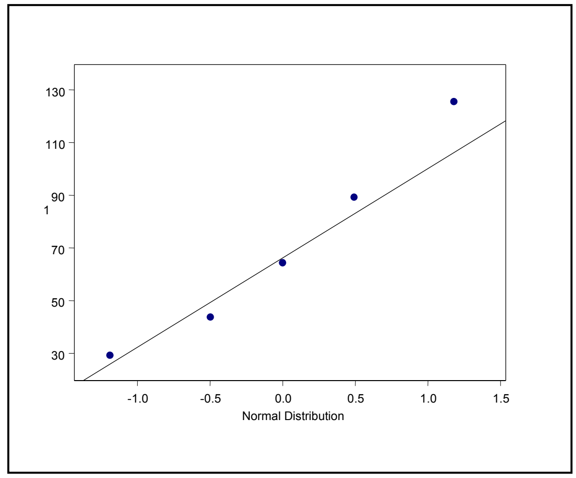


Figure E-32. Normal-quantile plot for ^{235}U data.

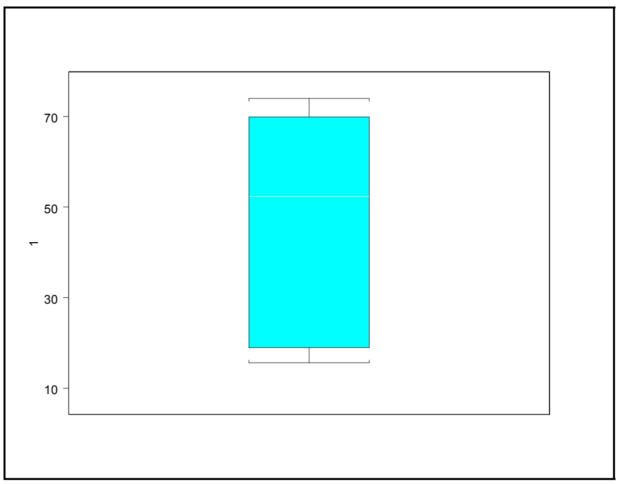


Figure E-33. Boxplot for log of ^{238}U data.

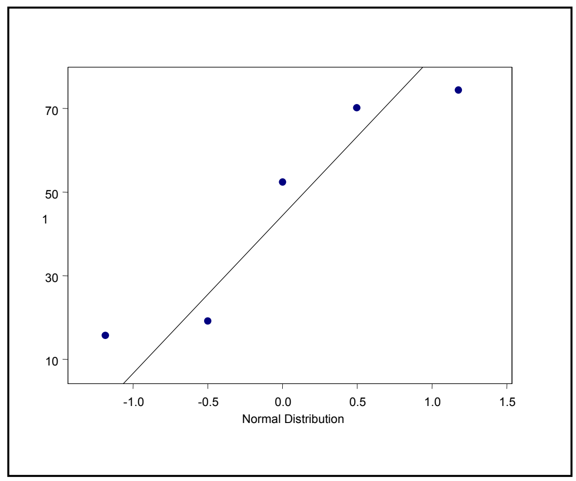
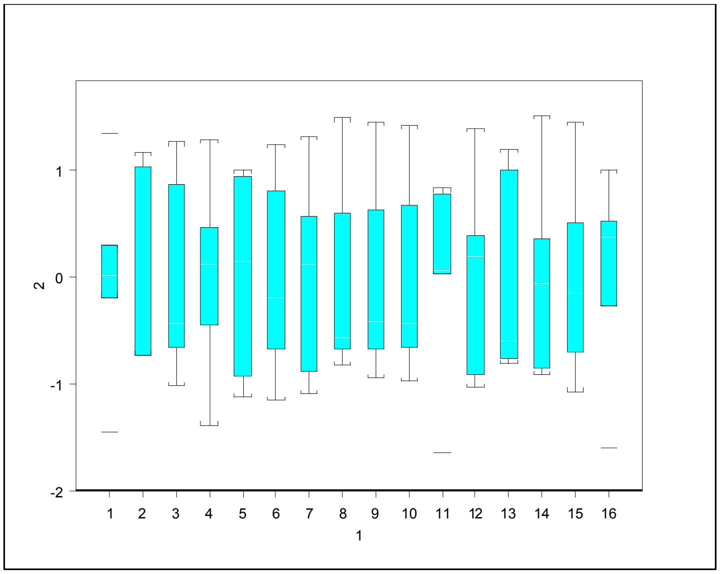


Figure E-34. Normal-quantile plot for ^{238}U data.



These numbers correspond to the numbers on the grouped boxplot.

1	^{241}Am
2	^{14}C
3	^{137}Cs
4	^{242}Cm
5	^{244}Cm
6	^{129}I
7	^{237}Np
8	^{63}Ni
9	^{238}Pu
10	^{239}Pu
11	^{241}Pu
12	Total Sr
13	^{3}H
14	^{234}U
15	^{235}U
16	^{238}U

Figure E-35. Grouped boxplots of radionuclide data. Data have been standardized so that distributions are directly comparable.

Appendix F

Reported Results for Organics

Table F-1. Reported results for organics.

Field Sample ID	Location	Lab Sample ID	Class	CAS Number[a]	Analyte	Result	Units	Lab Flag[b]	Validator Flag[c]
CP10060101VG	WM-183 TR-13	0301036-18	VOC	67-64-1	Acetone	960	µg/L	E	U
CP10060201VG	WM-183 TR-53	0301036-01	VOC	67-64-1	Acetone	398	µg/L	E	U
CP10060301VG	WM-183 TR-54	0301036-05	VOC	67-64-1	Acetone	1200	µg/L	E	U
CP10060401VG	WM-183 TR-53	0301036-15	VOC	67-64-1	Acetone	766	µg/L	E	U
CP10060501VG	WM-183 TR-54	0301036-17	VOC	67-64-1	Acetone	755	µg/L	E	U
CP10060101VGDL	WM-183 TR-13	0301036-18BDL	VOC	67-64-1	Acetone	1290	µg/L	D	
CP10060201VGDL	WM-183 TR-53	0301036-01BDL	VOC	67-64-1	Acetone	61.5	µg/L	DJ	
CP10060301VGDL	WM-183 TR-54	0301036-05BDL	VOC	67-64-1	Acetone	38.5	µg/L	DJ	
CP10060401VGDL	WM-183 TR-53	0301036-15BDL	VOC	67-64-1	Acetone	343	µg/L	D	
CP10060501VGDL	WM-183 TR-54	0301036-17BDL	VOC	67-64-1	Acetone	210	µg/L	D	
CP10060101VG	WM-183 TR-13	0301036-18	VOC	78-93-3	2-Butanone	44.9	µg/L		
CP10060201VG	WM-183 TR-53	0301036-01	VOC	78-93-3	2-Butanone	18.8	µg/L		
CP10060301VG	WM-183 TR-54	0301036-05	VOC	78-93-3	2-Butanone	17.3	µg/L		
CP10060401VG	WM-183 TR-53	0301036-15	VOC	78-93-3	2-Butanone	14.1	µg/L		
CP10060501VG	WM-183 TR-54	0301036-17	VOC	78-93-3	2-Butanone	16.7	µg/L		
CP10060101SVRI	WM-183 TR-13	0301036-13A	Semivolatile	105-60-2	Caprolactam	2.9	µg/L	J	J
CP10060201SVRI	WM-183 TR-53	0301036-03A	Semivolatile	105-60-2	Caprolactam	10.3	µg/L	U	R
CP10060301SVRI	WM-183 TR-54	0301036-07A	Semivolatile	105-60-2	Caprolactam	10.3	µg/L	U	R
CP10060401SVRI	WM-183 TR-53	0301036-11A	Semivolatile	105-60-2	Caprolactam	10.9	µg/L	U	R
CP10060501SVRI	WM-183 TR-54	0301036-12A	Semivolatile	105-60-2	Caprolactam	11.5	µg/L	U	R
CP10060101SVRI	WM-183 TR-13	0301036-13A	Semivolatile	88-75-5	2-Nitrophenol	1.2	µg/L	J	J
CP10060201SVRI	WM-183 TR-53	0301036-03A	Semivolatile	88-75-5	2-Nitrophenol	10.3	µg/L	U	R
CP10060301SVRI	WM-183 TR-54	0301036-07A	Semivolatile	88-75-5	2-Nitrophenol	10.3	µg/L	U	R
CP10060401SVRI	WM-183 TR-53	0301036-11A	Semivolatile	88-75-5	2-Nitrophenol	10.9	µg/L	U	R
CP10060501SVRI	WM-183 TR-54	0301036-12A	Semivolatile	88-75-5	2-Nitrophenol	11.5	µg/L	U	R

Table F-1. (continued).

Field Sample ID	Location	Lab Sample ID	Class	CAS Number[a]	Analyte	Result	Units	Lab Flag[b]	Validator Flag[c]
CP10060101SVRI	WM-183 TR-13	0301036-13A	Semivolatile	100-02-7	4-Nitrophenol	6.4	µg/L	J	J
CP10060201SVRI	WM-183 TR-53	0301036-03A	Semivolatile	100-02-7	4-Nitrophenol	3.3	µg/L	J	J
CP10060301SVRI	WM-183 TR-54	0301036-07A	Semivolatile	100-02-7	4-Nitrophenol	4.3	µg/L	J	J
CP10060401SVRI	WM-183 TR-53	0301036-11A	Semivolatile	100-02-7	4-Nitrophenol	10.9	µg/L	U	R
CP10060501SVRI	WM-183 TR-54	0301036-12A	Semivolatile	100-02-7	4-Nitrophenol	11.5	µg/L	U	R
CP10060101SVRI	WM-183 TR-13	0301036-13A	Semivolatile	62-75-9	n-Nitrosodimethylamine	1.3	µg/L	J	J
CP10060201SVRI	WM-183 TR-53	0301036-03A	Semivolatile	62-75-9	n-Nitrosodimethylamine	2.3	µg/L	J	J
CP10060301SVRI	WM-183 TR-54	0301036-07A	Semivolatile	62-75-9	n-Nitrosodimethylamine	2.1	µg/L	J	J
CP10060401SVRI	WM-183 TR-53	0301036-11A	Semivolatile	62-75-9	n-Nitrosodimethylamine	1.8	µg/L	J	J
CP10060501SVRI	WM-183 TR-54	0301036-12A	Semivolatile	62-75-9	n-Nitrosodimethylamine	1.6	µg/L	J	J
CP10060101SVRI	WM-183 TR-13	0301036-13A	Semivolatile	108-60-1	2,2'-oxybis(1-Chloropropane)	0.097	µg/L	J	J
CP10060201SVRI	WM-183 TR-53	0301036-03A	Semivolatile	108-60-1	2,2'-oxybis(1-Chloropropane)	10.3	µg/L	U	R
CP10060301SVRI	WM-183 TR-54	0301036-07A	Semivolatile	108-60-1	2,2'-oxybis(1-Chloropropane)	10.3	µg/L	U	R
CP10060401SVRI	WM-183 TR-53	0301036-11A	Semivolatile	108-60-1	2,2'-oxybis(1-Chloropropane)	10.9	µg/L	U	R
CP10060501SVRI	WM-183 TR-54	0301036-12A	Semivolatile	108-60-1	2,2'-oxybis(1-Chloropropane)	11.5	µg/L	U	R
CP10060101SVRI	WM-183 TR-13	0301036-13A	Semivolatile	108-95-2	Phenol	5.0	µg/L	J	J
CP10060201SVRI	WM-183 TR-53	0301036-03A	Semivolatile	108-95-2	Phenol	10.3	µg/L	U	R
CP10060301SVRI	WM-183 TR-54	0301036-07A	Semivolatile	108-95-2	Phenol	10.3	µg/L	U	R
CP10060401SVRI	WM-183 TR-53	0301036-11A	Semivolatile	108-95-2	Phenol	3.0	µg/L	J	J
CP10060501SVRI	WM-183 TR-54	0301036-12A	Semivolatile	108-95-2	Phenol	2.7	µg/L	J	J
CP10060101SVRI	WM-183 TR-13	0301036-13A	Semivolatile	110-86-1	Pyridine	10.0	µg/L	U	R
CP10060201SVRI	WM-183 TR-53	0301036-03A	Semivolatile	110-86-1	Pyridine	10.3	µg/L	U	R
CP10060301SVRI	WM-183 TR-54	0301036-07A	Semivolatile	110-86-1	Pyridine	10.3	µg/L	U	R
CP10060401SVRI	WM-183 TR-53	0301036-11A	Semivolatile	110-86-1	Pyridine	25.2	µg/L		J
CP10060501SVRI	WM-183 TR-54	0301036-12A	Semivolatile	110-86-1	Pyridine	26.2	µg/L		J
CP10060101SVRI	WM-183 TR-13	0301036-13A	Semivolatile	126-73-8	Tri-n-butyl phosphate	11.6	µg/L		J
CP10060201SVRI	WM-183 TR-53	0301036-03A	Semivolatile	126-73-8	Tri-n-butyl phosphate	10.3	µg/L		J
CP10060301SVRI	WM-183 TR-54	0301036-07A	Semivolatile	126-73-8	Tri-n-butyl phosphate	9.7	µg/L	J	J
CP10060401SVRI	WM-183 TR-53	0301036-11A	Semivolatile	126-73-8	Tri-n-butyl phosphate	16.1	µg/L		J
CP10060501SVRI	WM-183 TR-54	0301036-12A	Semivolatile	126-73-8	Tri-n-butyl phosphate	8.5	µg/L	J	J

Table F-1. (continued).

Field Sample ID	Location	Lab Sample ID	Class	CAS Number[a]	Analyte	Result	Units	Lab Flag[b]	Validator Flag[c]
CP10060101SVRI	WM-183 TR-13	0301036-13A	Semivolatile	112-37-8	Undecanoic Acid	58	µg/L	NJ	NJ
CP10060201SVRI	WM-183 TR-53	0301036-03A	Semivolatile	112-37-8	Undecanoic Acid	97.1	µg/L	NJ	NJ
CP10060301SVRI	WM-183 TR-54	0301036-07A	Semivolatile	112-37-8	Undecanoic Acid	10.2	µg/L	NJ	NJ
CP10060401SVRI	WM-183 TR-53	0301036-11A	Semivolatile	112-37-8	Undecanoic Acid	6.6	µg/L	NJ	NJ
CP10060501SVRI	WM-183 TR-54	0301036-12A	Semivolatile	112-37-8	Undecanoic Acid	5.2	µg/L	NJ	NJ

a. CAS = Chemical Abstract Service.

b. Laboratory flags:
E = Concentrations exceed the calibration range of the GC/MS instrument.
D = Identified in an analysis at a secondary dilution factor.
J = Estimated value.
N = Presumptive evidence of a compound.
U = Analyte was analyzed for but not detected. Analyte result was below the contract required quantitation limit.

c. Validator flags:
J = Estimated value
NJ = Estimated value based on presumptive evidence
R = Rejected
U = Undetected.

Appendix G

Reported Results for Metals

Table G-1. Reported results for metals.

Field Sample ID	Location	Lab Sample ID	CAS Number[a]	Analyte	Result	Units	Lab Flag[b]	Validator Flag
CP10060101XM	WM-183 TR-13	3AC52	7429-90-5	Aluminum	4.30E+04	µg/L		
CP10060201XM	WM-183 TR-53	3AC23	7429-90-5	Aluminum	8.02E+04	µg/L		
CP10060301XM	WM-183 TR-54	3AC29	7429-90-5	Aluminum	5.77E+04	µg/L		
CP10060401XM	WM-183 TR-53	3AC35	7429-90-5	Aluminum	4.32E+04	µg/L		
CP10060501XM	WM-183 TR-54	3AC39	7429-90-5	Aluminum	4.72E+04	µg/L		
CP10062201XM	WM-183 TR-53 (After Rewash)	3AM17	7429-90-5	Aluminum	3.12E+02	µg/L		
CP10062301XM	WM-183 TR-54 (After Rewash)	3AM18	7429-90-5	Aluminum	2.44E+02	µg/L		
CP10062401XM	WM-183 TR-13 (After Rewash)	3AM27	7429-90-5	Aluminum	2.16E+02	µg/L		
CP10062501XM	WM-183 TR-53 (After Rewash)	3AM28	7429-90-5	Aluminum	3.51E+02	µg/L		
CP10062601XM	WM-183 TR-54 (After Rewash)	3AM29	7429-90-5	Aluminum	2.00E+02	µg/L		
CP10060101XM	WM-183 TR-13	3AC52	7440-36-0	Antimony	2.90E+00	µg/L	U	
CP10060201XM	WM-183 TR-53	3AC23	7440-36-0	Antimony	2.90E+00	µg/L	U	
CP10060301XM	WM-183 TR-54	3AC29	7440-36-0	Antimony	2.90E+00	µg/L	U	
CP10060401XM	WM-183 TR-53	3AC35	7440-36-0	Antimony	2.90E+00	µg/L	U	
CP10060501XM	WM-183 TR-54	3AC39	7440-36-0	Antimony	2.90E+00	µg/L	U	
CP10062201XM	WM-183 TR-53 (After Rewash)	3AM17	7440-36-0	Antimony	4.50E+00	µg/L	U	
CP10062301XM	WM-183 TR-54 (After Rewash)	3AM18	7440-36-0	Antimony	4.50E+00	µg/L	U	
CP10062401XM	WM-183 TR-13 (After Rewash)	3AM27	7440-36-0	Antimony	4.50E+00	µg/L	U	
CP10062501XM	WM-183 TR-53 (After Rewash)	3AM28	7440-36-0	Antimony	4.50E+00	µg/L	U	
CP10062601XM	WM-183 TR-54 (After Rewash)	3AM29	7440-36-0	Antimony	4.50E+00	µg/L	U	
CP10060101XM	WM-183 TR-13	3AC52	7440-38-2	Arsenic	4.00E+00	µg/L	U	
CP10060201XM	WM-183 TR-53	3AC23	7440-38-2	Arsenic	4.00E+00	µg/L	U	
CP10060301XM	WM-183 TR-54	3AC29	7440-38-2	Arsenic	5.30E+00	µg/L	B	
CP10060401XM	WM-183 TR-53	3AC35	7440-38-2	Arsenic	4.00E+00	µg/L	U	
CP10060501XM	WM-183 TR-54	3AC39	7440-38-2	Arsenic	4.00E+00	µg/L	U	
CP10062201XM	WM-183 TR-53 (After Rewash)	3AM17	7440-38-2	Arsenic	4.30E+00	µg/L	U	
CP10062301XM	WM-183 TR-54 (After Rewash)	3AM18	7440-38-2	Arsenic	4.30E+00	µg/L	U	
CP10062401XM	WM-183 TR-13 (After Rewash)	3AM27	7440-38-2	Arsenic	4.30E+00	µg/L	U	
CP10062501XM	WM-183 TR-53 (After Rewash)	3AM28	7440-38-2	Arsenic	4.30E+00	µg/L	U	

Table G-1. (continued).

Field Sample ID	Location	Lab Sample ID	CAS Number[a]	Analyte	Result	Units	Lab Flag[b]	Validator Flag
CP10062601XM	WM-183 TR-54 (After Rewash)	3AM29	7440-38-2	Arsenic	4.30E+00	µg/L	U	
CP10060101XM	WM-183 TR-13	3AC52	7440-39-3	Barium	1.09E+02	µg/L		
CP10060201XM	WM-183 TR-53	3AC23	7440-39-3	Barium	5.99E+01	µg/L		
CP10060301XM	WM-183 TR-54	3AC29	7440-39-3	Barium	5.32E+01	µg/L		
CP10060401XM	WM-183 TR-53	3AC35	7440-39-3	Barium	3.80E+01	µg/L		
CP10060501XM	WM-183 TR-54	3AC39	7440-39-3	Barium	1.46E+02	µg/L		
CP10062201XM	WM-183 TR-53 (After Rewash)	3AM17	7440-39-3	Barium	1.40E+00	µg/L	B	
CP10062301XM	WM-183 TR-54 (After Rewash)	3AM18	7440-39-3	Barium	1.80E+00	µg/L	B	
CP10062401XM	WM-183 TR-13 (After Rewash)	3AM27	7440-39-3	Barium	8.00E–01	µg/L	B	
CP10062501XM	WM-183 TR-53 (After Rewash)	3AM28	7440-39-3	Barium	1.30E+00	µg/L	B	
CP10062601XM	WM-183 TR-54 (After Rewash)	3AM29	7440-39-3	Barium	1.60E+00	µg/L	B	
CP10060101XM	WM-183 TR-13	3AC52	7440-41-7	Beryllium	2.00E–01	µg/L	B	
CP10060201XM	WM-183 TR-53	3AC23	7440-41-7	Beryllium	4.00E–01	µg/L	B	
CP10060301XM	WM-183 TR-54	3AC29	7440-41-7	Beryllium	3.00E–01	µg/L	B	
CP10060401XM	WM-183 TR-53	3AC35	7440-41-7	Beryllium	2.00E–01	µg/L	B	
CP10060501XM	WM-183 TR-54	3AC39	7440-41-7	Beryllium	2.00E–01	µg/L	B	
CP10062201XM	WM-183 TR-53 (After Rewash)	3AM17	7440-41-7	Beryllium	1.00E–01	µg/L	U	
CP10062301XM	WM-183 TR-54 (After Rewash)	3AM18	7440-41-7	Beryllium	1.00E–01	µg/L	U	
CP10062401XM	WM-183 TR-13 (After Rewash)	3AM27	7440-41-7	Beryllium	1.00E–01	µg/L	U	
CP10062501XM	WM-183 TR-53 (After Rewash)	3AM28	7440-41-7	Beryllium	1.00E–01	µg/L	U	
CP10062601XM	WM-183 TR-54 (After Rewash)	3AM29	7440-41-7	Beryllium	1.00E–01	µg/L	U	
CP10060101XM	WM-183 TR-13	3AC52	7440-43-9	Cadmium	3.08E+02	µg/L		
CP10060201XM	WM-183 TR-53	3AC23	7440-43-9	Cadmium	5.17E+02	µg/L		
CP10060301XM	WM-183 TR-54	3AC29	7440-43-9	Cadmium	4.26E+02	µg/L		
CP10060401XM	WM-183 TR-53	3AC35	7440-43-9	Cadmium	3.11E+02	µg/L		
CP10060501XM	WM-183 TR-54	3AC39	7440-43-9	Cadmium	3.27E+02	µg/L		
CP10062201XM	WM-183 TR-53 (After Rewash)	3AM17	7440-43-9	Cadmium	1.80E+00	µg/L	B	
CP10062301XM	WM-183 TR-54 (After Rewash)	3AM18	7440-43-9	Cadmium	1.20E+00	µg/L	B	
CP10062401XM	WM-183 TR-13 (After Rewash)	3AM27	7440-43-9	Cadmium	1.40E+00	µg/L	B	

Table G-1. (continued).

Field Sample ID	Location	Lab Sample ID	CAS Number[a]	Analyte	Result	Units	Lab Flag[b]	Validator Flag
CP10062501XM	WM-183 TR-53 (After Rewash)	3AM28	7440-43-9	Cadmium	2.00E+00	µg/L	B	
CP10062601XM	WM-183 TR-54 (After Rewash)	3AM29	7440-43-9	Cadmium	1.10E+00	µg/L	B	
CP10060101XM	WM-183 TR-13	3AC52	7440-70-2	Calcium	5.41E+03	µg/L		
CP10060201XM	WM-183 TR-53	3AC23	7440-70-2	Calcium	8.56E+03	µg/L		
CP10060301XM	WM-183 TR-54	3AC29	7440-70-2	Calcium	7.74E+03	µg/L		
CP10060401XM	WM-183 TR-53	3AC35	7440-70-2	Calcium	5.31E+03	µg/L		
CP10060501XM	WM-183 TR-54	3AC39	7440-70-2	Calcium	6.07E+03	µg/L		
CP10062201XM	WM-183 TR-53 (After Rewash)	3AM17	7440-70-2	Calcium	6.51E+01	µg/L		
CP10062301XM	WM-183 TR-54 (After Rewash)	3AM18	7440-70-2	Calcium	5.74E+01	µg/L		
CP10062401XM	WM-183 TR-13 (After Rewash)	3AM27	7440-70-2	Calcium	5.12E+01	µg/L		
CP10062501XM	WM-183 TR-53 (After Rewash)	3AM28	7440-70-2	Calcium	6.05E+01	µg/L		
CP10062601XM	WM-183 TR-54 (After Rewash)	3AM29	7440-70-2	Calcium	4.95E+01	µg/L		
CP10060101XM	WM-183 TR-13	3AC52	7440-47-3	Chromium	1.39E+03	µg/L		
CP10060201XM	WM-183 TR-53	3AC23	7440-47-3	Chromium	2.82E+03	µg/L		
CP10060301XM	WM-183 TR-54	3AC29	7440-47-3	Chromium	2.03E+03	µg/L		
CP10060401XM	WM-183 TR-53	3AC35	7440-47-3	Chromium	1.44E+03	µg/L		
CP10060501XM	WM-183 TR-54	3AC39	7440-47-3	Chromium	1.56E+03	µg/L		
CP10062201XM	WM-183 TR-53 (After Rewash)	3AM17	7440-47-3	Chromium	1.11E+01	µg/L		
CP10062301XM	WM-183 TR-54 (After Rewash)	3AM18	7440-47-3	Chromium	6.80E+00	µg/L		
CP10062401XM	WM-183 TR-13 (After Rewash)	3AM27	7440-47-3	Chromium	5.20E+00	µg/L		
CP10062501XM	WM-183 TR-53 (After Rewash)	3AM28	7440-47-3	Chromium	1.15E+01	µg/L		
CP10062601XM	WM-183 TR-54 (After Rewash)	3AM29	7440-47-3	Chromium	6.00E+00	µg/L		
CP10060101XM	WM-183 TR-13	3AC52	7440-48-4	Cobalt	2.10E+01	µg/L		
CP10060201XM	WM-183 TR-53	3AC23	7440-48-4	Cobalt	3.47E+01	µg/L		
CP10060301XM	WM-183 TR-54	3AC29	7440-48-4	Cobalt	2.91E+01	µg/L		
CP10060401XM	WM-183 TR-53	3AC35	7440-48-4	Cobalt	2.06E+01	µg/L		
CP10060501XM	WM-183 TR-54	3AC39	7440-48-4	Cobalt	2.23E+01	µg/L		
CP10062201XM	WM-183 TR-53 (After Rewash)	3AM17	7440-48-4	Cobalt	9.00E–01	µg/L	U	
CP10062301XM	WM-183 TR-54 (After Rewash)	3AM18	7440-48-4	Cobalt	9.00E–01	µg/L	U	
CP10062401XM	WM-183 TR-13 (After Rewash)	3AM27	7440-48-4	Cobalt	9.00E–01	µg/L	U	

Table G-1. (continued).

Field Sample ID	Location	Lab Sample ID	CAS Number[a]	Analyte	Result	Units	Lab Flag[b]	Validator Flag
CP10062501XM	WM-183 TR-53 (After Rewash)	3AM28	7440-48-4	Cobalt	9.00E−01	µg/L	U	
CP10062601XM	WM-183 TR-54 (After Rewash)	3AM29	7440-48-4	Cobalt	9.00E−01	µg/L	U	
CP10060101XM	WM-183 TR-13	3AC52	7440-50-8	Copper	8.26E+01	µg/L		
CP10060201XM	WM-183 TR-53	3AC23	7440-50-8	Copper	1.41E+02	µg/L		
CP10060301XM	WM-183 TR-54	3AC29	7440-50-8	Copper	1.17E+02	µg/L		
CP10060401XM	WM-183 TR-53	3AC35	7440-50-8	Copper	8.19E+01	µg/L		
CP10060501XM	WM-183 TR-54	3AC39	7440-50-8	Copper	8.72E+01	µg/L		
CP10062201XM	WM-183 TR-53 (After Rewash)	3AM17	7440-50-8	Copper	1.70E+00	µg/L	B	
CP10062301XM	WM-183 TR-54 (After Rewash)	3AM18	7440-50-8	Copper	1.00E+00	µg/L	U	
CP10062401XM	WM-183 TR-13 (After Rewash)	3AM27	7440-50-8	Copper	1.50E+00	µg/L	B	
CP10062501XM	WM-183 TR-53 (After Rewash)	3AM28	7440-50-8	Copper	1.30E+00	µg/L	B	
CP10062601XM	WM-183 TR-54 (After Rewash)	3AM29	7440-50-8	Copper	5.20E+00	µg/L	B	
CP10060101XM	WM-183 TR-13	3AC52	7439-89-6	Iron	8.02E+02	µg/L		
CP10060201XM	WM-183 TR-53	3AC23	7439-89-6	Iron	3.42E+03	µg/L		
CP10060301XM	WM-183 TR-54	3AC29	7439-89-6	Iron	1.85E+03	µg/L		
CP10060401XM	WM-183 TR-53	3AC35	7439-89-6	Iron	8.34E+02	µg/L		
CP10060501XM	WM-183 TR-54	3AC39	7439-89-6	Iron	9.54E+02	µg/L		
CP10062201XM	WM-183 TR-53 (After Rewash)	3AM17	7439-89-6	Iron	8.06E+02	µg/L		
CP10062301XM	WM-183 TR-54 (After Rewash)	3AM18	7439-89-6	Iron	3.20E+02	µg/L		
CP10062401XM	WM-183 TR-13 (After Rewash)	3AM27	7439-89-6	Iron	9.26E+01	µg/L		
CP10062501XM	WM-183 TR-53 (After Rewash)	3AM28	7439-89-6	Iron	7.14E+02	µg/L		
CP10062601XM	WM-183 TR-54 (After Rewash)	3AM29	7439-89-6	Iron	2.78E+02	µg/L		
CP10060101XM	WM-183 TR-13	3AC52	7439-92-1	Lead	1.30E+02	µg/L		
CP10060201XM	WM-183 TR-53	3AC23	7439-92-1	Lead	2.88E+02	µg/L		
CP10060301XM	WM-183 TR-54	3AC29	7439-92-1	Lead	1.99E+02	µg/L		
CP10060401XM	WM-183 TR-53	3AC35	7439-92-1	Lead	1.26E+02	µg/L		
CP10060501XM	WM-183 TR-54	3AC39	7439-92-1	Lead	1.39E+02	µg/L		
CP10062201XM	WM-183 TR-53 (After Rewash)	3AM17	7439-92-1	Lead	1.05E+01	µg/L	B	
CP10062301XM	WM-183 TR-54 (After Rewash)	3AM18	7439-92-1	Lead	7.30E+00	µg/L	U	
CP10062401XM	WM-183 TR-13 (After Rewash)	3AM27	7439-92-1	Lead	7.30E+00	µg/L	U	

Table G-1. (continued).

Field Sample ID	Location	Lab Sample ID	CAS Number[a]	Analyte	Result	Units	Lab Flag[b]	Validator Flag
CP10062501XM	WM-183 TR-53 (After Rewash)	3AM28	7439-92-1	Lead	7.80E+00	µg/L	B	
CP10062601XM	WM-183 TR-54 (After Rewash)	3AM29	7439-92-1	Lead	7.30E+00	µg/L	U	
CP10060401XM	WM-183 TR-53	3AC35	7439-95-4	Magnesium	9.27E+02	µg/L		
CP10060101XM	WM-183 TR-13	3AC52	7439-95-4	Magnesium	9.63E+02	µg/L		
CP10060501XM	WM-183 TR-54	3AC39	7439-95-4	Magnesium	1.05E+03	µg/L		
CP10060301XM	WM-183 TR-54	3AC29	7439-95-4	Magnesium	1.26E+03	µg/L		
CP10060201XM	WM-183 TR-53	3AC23	7439-95-4	Magnesium	1.49E+03	µg/L		
CP10062301XM	WM-183 TR-54 (After Rewash)	3AM18	7439-95-4	Magnesium	1.08E+01	µg/L	U	
CP10062401XM	WM-183 TR-13 (After Rewash)	3AM27	7439-95-4	Magnesium	1.08E+01	µg/L	U	
CP10062601XM	WM-183 TR-54 (After Rewash)	3AM29	7439-95-4	Magnesium	1.10E+01	µg/L	B	
CP10062501XM	WM-183 TR-53 (After Rewash)	3AM28	7439-95-4	Magnesium	1.43E+01	µg/L	B	
CP10062201XM	WM-183 TR-53 (After Rewash)	3AM17	7439-95-4	Magnesium	1.49E+01	µg/L	B	
CP10060401XM	WM-183 TR-53	3AC35	7439-96-5	Manganese	1.55E+03	µg/L		
CP10060101XM	WM-183 TR-13	3AC52	7439-96-5	Manganese	1.60E+03	µg/L		
CP10060501XM	WM-183 TR-54	3AC39	7439-96-5	Manganese	1.72E+03	µg/L		
CP10060301XM	WM-183 TR-54	3AC29	7439-96-5	Manganese	2.26E+03	µg/L		
CP10060201XM	WM-183 TR-53	3AC23	7439-96-5	Manganese	2.78E+03	µg/L		
CP10062601XM	WM-183 TR-54 (After Rewash)	3AM29	7439-96-5	Manganese	7.20E+00	µg/L		
CP10062401XM	WM-183 TR-13 (After Rewash)	3AM27	7439-96-5	Manganese	7.80E+00	µg/L		
CP10062301XM	WM-183 TR-54 (After Rewash)	3AM18	7439-96-5	Manganese	9.00E+00	µg/L		
CP10062201XM	WM-183 TR-53 (After Rewash)	3AM17	7439-96-5	Manganese	1.23E+01	µg/L		
CP10062501XM	WM-183 TR-53 (After Rewash)	3AM28	7439-96-5	Manganese	1.35E+01	µg/L		
CP10060101XM	WM-183 TR-13	3AC52	7439-97-6	Mercury	3.79E+03	µg/L		
CP10060201XM	WM-183 TR-53	3AC23	7439-97-6	Mercury	5.43E+03	µg/L		
CP10060301XM	WM-183 TR-54	3AC29	7439-97-6	Mercury	5.43E+03	µg/L		
CP10060401XM	WM-183 TR-53	3AC35	7439-97-6	Mercury	3.88E+03	µg/L		
CP10060501XM	WM-183 TR-54	3AC39	7439-97-6	Mercury	4.10E+03	µg/L		
CP10062201XM	WM-183 TR-53 (After Rewash)	3AM17	7439-97-6	Mercury	7.07E+01	µg/L		
CP10062301XM	WM-183 TR-54 (After Rewash)	3AM18	7439-97-6	Mercury	7.09E+01	µg/L		
CP10062401XM	WM-183 TR-13 (After Rewash)	3AM27	7439-97-6	Mercury	6.39E+01	µg/L		

Table G-1. (continued).

Field Sample ID	Location	Lab Sample ID	CAS Number[a]	Analyte	Result	Units	Lab Flag[b]	Validator Flag
CP10062501XM	WM-183 TR-53 (After Rewash)	3AM28	7439-97-6	Mercury	7.06E+01	µg/L		
CP10062601XM	WM-183 TR-54 (After Rewash)	3AM29	7439-97-6	Mercury	5.38E+01	µg/L		
CP10060101XM	WM-183 TR-13	3AC52	7439-98-7	Molybdenum	7.04E+01	µg/L		
CP10060201XM	WM-183 TR-53	3AC23	7439-98-7	Molybdenum	1.27E+02	µg/L		
CP10060301XM	WM-183 TR-54	3AC29	7439-98-7	Molybdenum	1.39E+02	µg/L		
CP10060401XM	WM-183 TR-53	3AC35	7439-98-7	Molybdenum	6.83E+01	µg/L		
CP10060501XM	WM-183 TR-54	3AC39	7439-98-7	Molybdenum	7.03E+01	µg/L		
CP10062201XM	WM-183 TR-53 (After Rewash)	3AM17	7439-98-7	Molybdenum	2.81E+01	µg/L	B	
CP10062301XM	WM-183 TR-54 (After Rewash)	3AM18	7439-98-7	Molybdenum	1.78E+01	µg/L	B	
CP10062401XM	WM-183 TR-13 (After Rewash)	3AM27	7439-98-7	Molybdenum	7.10E+00	µg/L	B	
CP10062501XM	WM-183 TR-53 (After Rewash)	3AM28	7439-98-7	Molybdenum	3.27E+01	µg/L		
CP10062601XM	WM-183 TR-54 (After Rewash)	3AM29	7439-98-7	Molybdenum	1.53E+01	µg/L	B	
CP10060401XM	WM-183 TR-53	3AC35	7440-02-0	Nickel	9.68E+02	µg/L		
CP10060101XM	WM-183 TR-13	3AC52	7440-02-0	Nickel	9.75E+02	µg/L		
CP10060501XM	WM-183 TR-54	3AC39	7440-02-0	Nickel	1.10E+03	µg/L		
CP10060301XM	WM-183 TR-54	3AC29	7440-02-0	Nickel	1.39E+03	µg/L		
CP10060201XM	WM-183 TR-53	3AC23	7440-02-0	Nickel	1.60E+03	µg/L		
CP10062601XM	WM-183 TR-54 (After Rewash)	3AM29	7440-02-0	Nickel	6.80E+00	µg/L	B	
CP10062401XM	WM-183 TR-13 (After Rewash)	3AM27	7440-02-0	Nickel	7.70E+00	µg/L	B	
CP10062301XM	WM-183 TR-54 (After Rewash)	3AM18	7440-02-0	Nickel	9.30E+00	µg/L	B	
CP10062201XM	WM-183 TR-53 (After Rewash)	3AM17	7440-02-0	Nickel	1.00E+01	µg/L	B	
CP10062501XM	WM-183 TR-53 (After Rewash)	3AM28	7440-02-0	Nickel	1.11E+01	µg/L		
CP10060401XM	WM-183 TR-53	3AC35	7440-09-7	Potassium	1.42E+04	µg/L		
CP10060101XM	WM-183 TR-13	3AC52	7440-09-7	Potassium	1.45E+04	µg/L		
CP10060501XM	WM-183 TR-54	3AC39	7440-09-7	Potassium	1.54E+04	µg/L		
CP10060301XM	WM-183 TR-54	3AC29	7440-09-7	Potassium	1.96E+04	µg/L		
CP10060201XM	WM-183 TR-53	3AC23	7440-09-7	Potassium	2.15E+04	µg/L		
CP10062601XM	WM-183 TR-54 (After Rewash)	3AM29	7440-09-7	Potassium	4.00E+02	µg/L	B	
CP10062401XM	WM-183 TR-13 (After Rewash)	3AM27	7440-09-7	Potassium	4.18E+02	µg/L	B	
CP10062301XM	WM-183 TR-54 (After Rewash)	3AM18	7440-09-7	Potassium	4.66E+02	µg/L	B	

Table G-1. (continued).

Field Sample ID	Location	Lab Sample ID	CAS Number[a]	Analyte	Result	Units	Lab Flag[b]	Validator Flag
CP10062201XM	WM-183 TR-53 (After Rewash)	3AM17	7440-09-7	Potassium	5.53E+02	µg/L	B	
CP10062501XM	WM-183 TR-53 (After Rewash)	3AM28	7440-09-7	Potassium	6.03E+02	µg/L	B	
CP10060101XM	WM-183 TR-13	3AC52	7782-49-2	Selenium	3.60E+00	µg/L	U	
CP10060201XM	WM-183 TR-53	3AC23	7782-49-2	Selenium	3.60E+00	µg/L	U	
CP10060301XM	WM-183 TR-54	3AC29	7782-49-2	Selenium	3.60E+00	µg/L	U	
CP10060401XM	WM-183 TR-53	3AC35	7782-49-2	Selenium	3.60E+00	µg/L	U	
CP10060501XM	WM-183 TR-54	3AC39	7782-49-2	Selenium	3.60E+00	µg/L	U	
CP10062201XM	WM-183 TR-53 (After Rewash)	3AM17	7782-49-2	Selenium	3.90E+00	µg/L	U	
CP10062301XM	WM-183 TR-54 (After Rewash)	3AM18	7782-49-2	Selenium	3.90E+00	µg/L	U	
CP10062401XM	WM-183 TR-13 (After Rewash)	3AM27	7782-49-2	Selenium	3.90E+00	µg/L	U	
CP10062501XM	WM-183 TR-53 (After Rewash)	3AM28	7782-49-2	Selenium	3.90E+00	µg/L	U	
CP10062601XM	WM-183 TR-54 (After Rewash)	3AM29	7782-49-2	Selenium	3.90E+00	µg/L	U	
CP10060101XM	WM-183 TR-13	3AC52	7440-22-4	Silver	1.14E+02	µg/L		
CP10060201XM	WM-183 TR-53	3AC23	7440-22-4	Silver	1.58E+02	µg/L		
CP10060301XM	WM-183 TR-54	3AC29	7440-22-4	Silver	1.71E+02	µg/L		
CP10060401XM	WM-183 TR-53	3AC35	7440-22-4	Silver	1.14E+02	µg/L		
CP10060501XM	WM-183 TR-54	3AC39	7440-22-4	Silver	1.28E+02	µg/L		
CP10062201XM	WM-183 TR-53 (After Rewash)	3AM17	7440-22-4	Silver	4.08E+01	µg/L		
CP10062301XM	WM-183 TR-54 (After Rewash)	3AM18	7440-22-4	Silver	3.16E+01	µg/L		
CP10062401XM	WM-183 TR-13 (After Rewash)	3AM27	7440-22-4	Silver	2.75E+01	µg/L		
CP10062501XM	WM-183 TR-53 (After Rewash)	3AM28	7440-22-4	Silver	5.07E+01	µg/L		
CP10062601XM	WM-183 TR-54 (After Rewash)	3AM29	7440-22-4	Silver	3.81E+01	µg/L		
CP10060101XM	WM-183 TR-13	3AC52	7440-23-5	Sodium	4.23E+04	µg/L		
CP10060201XM	WM-183 TR-53	3AC23	7440-23-5	Sodium	6.22E+04	µg/L		
CP10060301XM	WM-183 TR-54	3AC29	7440-23-5	Sodium	5.84E+04	µg/L		
CP10060401XM	WM-183 TR-53	3AC35	7440-23-5	Sodium	4.12E+04	µg/L		
CP10060501XM	WM-183 TR-54	3AC39	7440-23-5	Sodium	4.59E+04	µg/L		
CP10062201XM	WM-183 TR-53 (After Rewash)	3AM17	7440-23-5	Sodium	5.16E+02	µg/L		
CP10062301XM	WM-183 TR-54 (After Rewash)	3AM18	7440-23-5	Sodium	4.49E+02	µg/L		
CP10062401XM	WM-183 TR-13 (After Rewash)	3AM27	7440-23-5	Sodium	4.11E+02	µg/L		

Table G-1. (continued).

Field Sample ID	Location	Lab Sample ID	CAS Number[a]	Analyte	Result	Units	Lab Flag[b]	Validator Flag
CP10062501XM	WM-183 TR-53 (After Rewash)	3AM28	7440-23-5	Sodium	5.74E+02	µg/L		
CP10062601XM	WM-183 TR-54 (After Rewash)	3AM29	7440-23-5	Sodium	3.96E+02	µg/L		
CP10060101XM	WM-183 TR-13	3AC52	7440-28-0	Thallium	4.20E+00	µg/L	U	
CP10060201XM	WM-183 TR-53	3AC23	7440-28-0	Thallium	4.20E+00	µg/L	U	
CP10060301XM	WM-183 TR-54	3AC29	7440-28-0	Thallium	4.20E+00	µg/L	U	
CP10060401XM	WM-183 TR-53	3AC35	7440-28-0	Thallium	4.20E+00	µg/L	U	
CP10060501XM	WM-183 TR-54	3AC39	7440-28-0	Thallium	4.20E+00	µg/L	U	
CP10062201XM	WM-183 TR-53 (After Rewash)	3AM17	7440-28-0	Thallium	3.40E+00	µg/L	U	
CP10062301XM	WM-183 TR-54 (After Rewash)	3AM18	7440-28-0	Thallium	3.40E+00	µg/L	U	
CP10062401XM	WM-183 TR-13 (After Rewash)	3AM27	7440-28-0	Thallium	3.40E+00	µg/L	U	
CP10062501XM	WM-183 TR-53 (After Rewash)	3AM28	7440-28-0	Thallium	3.40E+00	µg/L	U	
CP10062601XM	WM-183 TR-54 (After Rewash)	3AM29	7440-28-0	Thallium	3.40E+00	µg/L	U	
CP10060101XM	WM-183 TR-13	3AC52	7440-62-2	Vanadium	1.50E+00	µg/L	B	
CP10060201XM	WM-183 TR-53	3AC23	7440-62-2	Vanadium	2.10E+00	µg/L	B	
CP10060301XM	WM-183 TR-54	3AC29	7440-62-2	Vanadium	1.20E+00	µg/L	B	
CP10060401XM	WM-183 TR-53	3AC35	7440-62-2	Vanadium	1.20E+00	µg/L	U	
CP10060501XM	WM-183 TR-54	3AC39	7440-62-2	Vanadium	1.20E+00	µg/L	U	
CP10062201XM	WM-183 TR-53 (After Rewash)	3AM17	7440-62-2	Vanadium	1.70E+00	µg/L	U	
CP10062301XM	WM-183 TR-54 (After Rewash)	3AM18	7440-62-2	Vanadium	1.70E+00	µg/L	U	
CP10062401XM	WM-183 TR-13 (After Rewash)	3AM27	7440-62-2	Vanadium	1.70E+00	µg/L	U	
CP10062501XM	WM-183 TR-53 (After Rewash)	3AM28	7440-62-2	Vanadium	1.70E+00	µg/L	U	
CP10062601XM	WM-183 TR-54 (After Rewash)	3AM29	7440-62-2	Vanadium	1.70E+00	µg/L	U	
CP10060101XM	WM-183 TR-13	3AC52	7440-66-6	Zinc	2.12E+02	µg/L		
CP10060201XM	WM-183 TR-53	3AC23	7440-66-6	Zinc	2.92E+02	µg/L		
CP10060301XM	WM-183 TR-54	3AC29	7440-66-6	Zinc	2.49E+02	µg/L		
CP10060401XM	WM-183 TR-53	3AC35	7440-66-6	Zinc	1.85E+02	µg/L		
CP10060501XM	WM-183 TR-54	3AC39	7440-66-6	Zinc	2.64E+02	µg/L		

Table G-1. (continued).

Field Sample ID	Location	Lab Sample ID	CAS Number[a]	Analyte	Result	Units	Lab Flag[b]	Validator Flag
CP10062201XM	WM-183 TR-53 (After Rewash)	3AM17	7440-66-6	Zinc	1.67E+01	µg/L		
CP10062301XM	WM-183 TR-54 (After Rewash)	3AM18	7440-66-6	Zinc	2.01E+01	µg/L		
CP10062401XM	WM-183 TR-13 (After Rewash)	3AM27	7440-66-6	Zinc	1.61E+01	µg/L		
CP10062501XM	WM-183 TR-53 (After Rewash)	3AM28	7440-66-6	Zinc	1.55E+01	µg/L		
CP10062601XM	WM-183 TR-54 (After Rewash)	3AM29	7440-66-6	Zinc	1.91E+01	µg/L		

a. CAS = Chemical Abstract Service.

b. Laboratory flags:
B = Value less than contract required detection limit but greater than or equal to instrument detection limit.
U = Analyte was analyzed for but not detected. Analyte result was below the contract required quantitation limit.

Appendix H

Reported Results for Anions

Table H-1. Reported results for anions.

Field Sample ID	Location	Lab Sample ID	Class	CAS Number	Analyte	Result	Units	Lab Flag[a]	Validator Flag[b]
CP10060101AN	WM-183 TR-13	3AC53	Miscellaneous	16887-00-6	Chloride	7.1	mg/L		
CP10060201AN	WM-183 TR-53	3AC24	Miscellaneous	16887-00-6	Chloride	6.9	mg/L		
CP10060301AN	WM-183 TR-54	3AC30	Miscellaneous	16887-00-6	Chloride	8.3	mg/L		
CP10060401AN	WM-183 TR-53	3AC36	Miscellaneous	16887-00-6	Chloride	8.0	mg/L		
CP10060501AN	WM-183 TR-54	3AC40	Miscellaneous	16887-00-6	Chloride	6.2	mg/L		
CP10060101AN	WM-183 TR-13	3AC53	Miscellaneous	16984-48-8	Fluoride	7.4	mg/L	E	R
CP10060201AN	WM-183 TR-53	3AC24	Miscellaneous	16984-48-8	Fluoride	6.4	mg/L		R
CP10060301AN	WM-183 TR-54	3AC30	Miscellaneous	16984-48-8	Fluoride	6.6	mg/L		R
CP10060401AN	WM-183 TR-53	3AC36	Miscellaneous	16984-48-8	Fluoride	7.0	mg/L		R
CP10060501AN	WM-183 TR-54	3AC40	Miscellaneous	16984-48-8	Fluoride	6.8	mg/L		R
CP10060101AN	WM-183 TR-13	3AC53	Miscellaneous	*NITRATE	Nitrate	137.5	mg-N/L		R
CP10060201AN	WM-183 TR-53	3AC24	Miscellaneous	*NITRATE	Nitrate	138.9	mg-N/L		R
CP10060301AN	WM-183 TR-54	3AC30	Miscellaneous	*NITRATE	Nitrate	186.2	mg-N/L		R
CP10060401AN	WM-183 TR-53	3AC36	Miscellaneous	*NITRATE	Nitrate	138.2	mg-N/L		R
CP10060501AN	WM-183 TR-54	3AC40	Miscellaneous	*NITRATE	Nitrate	141.9	mg-N/L		R
CP10060101AN	WM-183 TR-13	3AC53	Miscellaneous	14808-79-8	Sulfate	20.6	mg/L	E	J
CP10060201AN	WM-183 TR-53	3AC24	Miscellaneous	14808-79-8	Sulfate	29.2	mg/L		J
CP10060301AN	WM-183 TR-54	3AC30	Miscellaneous	14808-79-8	Sulfate	25.4	mg/L		J
CP10060401AN	WM-183 TR-53	3AC36	Miscellaneous	14808-79-8	Sulfate	19.7	mg/L		J
CP10060501AN	WM-183 TR-54	3AC40	Miscellaneous	14808-79-8	Sulfate	19.4	mg/L		J

a. Laboratory flags:
E = Reported value was estimated because of the presence of interference.
U = =Analyte was analyzed for but not detected. Analyte result was below the contract required quantitation limit.

b. Validator flags:
J = Estimated value
R = Rejected
U = Undetected.

Appendix I

Reported Results for pH

Table I-1. Reported results for pH.

Field Sample ID	Location	Lab Sample ID	Class	CAS Number	Analyte	Result	Units	Lab Flag	Validator Flag
CP10060101PH	WM-183 TR-13	3AC54	Miscellaneous	*PH	pH	2.4	N/A		
CP10060201PH	WM-183 TR-53	3AC25	Miscellaneous	*PH	pH	2.3	N/A		
CP10060301PH	WM-183 TR-54	3AC31	Miscellaneous	*PH	pH	2.3	N/A		
CP10060401PH	WM-183 TR-53	3AC37	Miscellaneous	*PH	pH	2.4	N/A		
CP10060501PH	WM-183 TR-54	3AC41	Miscellaneous	*PH	pH	2.4	N/A		

Appendix J

Reported Results for Radionuclides

Table J-1. Reported results for radionuclides.

Field Sample ID	Location	Lab Sample ID	Analysis Type	Analyte	Result	Units	Validator Flag[a]	MDA	0.5 × MDA[b]
CP10060101X3	WM-183 TR-13	3AC55	Rads	Am-241	1.83E+05	pCi/L		4.93E+02	2.47E+02
CP10060201X3	WM-183 TR-53	3AC26	Rads	Am-241	2.02E+05	pCi/L		1.72E+03	8.60E+02
CP10060301X3	WM-183 TR-54	3AC32	Rads	Am-241	1.87E+05	pCi/L		2.32E+03	1.16E+03
CP10060401X3	WM-183 TR-53	3AC38	Rads	Am-241	1.62E+05	pCi/L		5.13E+02	2.57E+02
CP10060501X3	WM-183 TR-54	3AC42	Rads	Am-241	1.80E+05	pCi/L		5.09E+02	2.55E+02
CP10060101X5	WM-183 TR-13	01E0-02-A	Rads	C-14	3.35E+00	pCi/L	U	1.38E+01	6.90E+00
CP10060201X5	WM-183 TR-53	01E0-04-A	Rads	C-14	1.00E+01	pCi/L	UJ	1.38E+01	6.90E+00
CP10060301X5	WM-183 TR-54	01E0-06-A	Rads	C-14	1.65E+01	pCi/L		1.38E+01	6.90E+00
CP10060401X5	WM-183 TR-53	01E0-08-A	Rads	C-14	1.72E+01	pCi/L		1.38E+01	6.90E+00
CP10060501X5	WM-183 TR-54	01E0-10-A	Rads	C-14	1.04E+01	pCi/L	UJ	1.38E+01	6.90E+00
CP10060101X3	WM-183 TR-13	3AC55	Rads	Cm-242	1.19E+02	pCi/L	J	1.78E+01	8.90E+00
CP10060201X3	WM-183 TR-53	3AC26	Rads	Cm-242	2.70E+02	pCi/L		1.75E+01	8.75E+00
CP10060301X3	WM-183 TR-54	3AC32	Rads	Cm-242	3.38E+02	pCi/L		2.30E+01	1.15E+01
CP10060401X3	WM-183 TR-53	3AC38	Rads	Cm-242	2.42E+02	pCi/L		1.92E+01	9.60E+00
CP10060501X3	WM-183 TR-54	3AC42	Rads	Cm-242	1.95E+02	pCi/L		2.22E+01	1.11E+01
CP10060101X3	WM-183 TR-13	3AC55	Rads	Cm-244	3.06E+03	pCi/L		2.93E+01	1.47E+01
CP10060201X3	WM-183 TR-53	3AC26	Rads	Cm-244	4.61E+03	pCi/L		2.89E+01	1.45E+01
CP10060301X3	WM-183 TR-54	3AC32	Rads	Cm-244	4.56E+03	pCi/L		2.30E+01	1.15E+01
CP10060401X3	WM-183 TR-53	3AC38	Rads	Cm-244	2.90E+03	pCi/L		1.92E+01	9.60E+00
CP10060501X3	WM-183 TR-54	3AC42	Rads	Cm-244	3.92E+03	pCi/L		2.66E+01	1.33E+01
CP10060101X3	WM-183 TR-13	3AC55	Gamma Scan	Co-60	1.81E+05	pCi/L		4.36E+03	2.18E+03
CP10060201X3	WM-183 TR-53	3AC26	Gamma Scan	Co-60	2.52E+05	pCi/L		7.06E+03	3.53E+03
CP10060301X3	WM-183 TR-54	3AC32	Gamma Scan	Co-60	2.06E+05	pCi/L		6.35E+03	3.18E+03
CP10060401X3	WM-183 TR-53	3AC38	Gamma Scan	Co-60	1.70E+05	pCi/L		4.34E+03	2.17E+03
CP10060501X3	WM-183 TR-54	3AC42	Gamma Scan	Co-60	1.95E+05	pCi/L		4.23E+03	2.12E+03
CP10062201R4	WM-183 TR-53 (After Rewash)	3AM23	Gamma Scan	Co-60	8.69E+03	pCi/L		1.99E+03	9.95E+02
CP10062301R4	WM-183 TR-54 (After Rewash)	3AM24	Gamma Scan	Co-60	5.47E+02	pCi/L	U	2.31E+03	1.16E+03

Table J-1. (continued).

Field Sample ID	Location	Lab Sample ID	Analysis Type	Analyte	Result	Units	Validator Flag[a]	MDA	0.5 × MDA[b]
CP10062401R4	WM-183 TR-13 (After Rewash)	3AM30	Gamma Scan	Co-60	8.59E+02	pCi/L	U	2.34E+03	1.17E+03
CP10062501R4	WM-183 TR-53 (After Rewash)	3AM31	Gamma Scan	Co-60	2.82E+03	pCi/L	U	2.85E+03	1.43E+03
CP10062601R4	WM-183 TR-54 (After Rewash)	3AM32	Gamma Scan	Co-60	3.15E+00	pCi/L	U	2.50E+03	1.25E+03
CP10060101X3	WM-183 TR-13	3AC55	Gamma Scan	Cs-134	1.78E+05	pCi/L		2.24E+04	1.12E+04
CP10060201X3	WM-183 TR-53	3AC26	Gamma Scan	Cs-134	1.83E+05	pCi/L		3.20E+04	1.60E+04
CP10060301X3	WM-183 TR-54	3AC32	Gamma Scan	Cs-134	2.59E+04	pCi/L	U	2.62E+04	1.31E+04
CP10060401X3	WM-183 TR-53	3AC38	Gamma Scan	Cs-134	1.85E+05	pCi/L	J	2.25E+04	1.13E+04
CP10060501X3	WM-183 TR-54	3AC42	Gamma Scan	Cs-134	1.97E+04	pCi/L	U	1.99E+04	9.95E+03
CP10062201R4	WM-183 TR-53 (After Rewash)	3AM23	Gamma Scan	Cs-134	2.84E+04	pCi/L		1.23E+04	6.15E+03
CP10062301R4	WM-183 TR-54 (After Rewash)	3AM24	Gamma Scan	Cs-134	8.42E+03	pCi/L	U	8.53E+03	4.27E+03
CP10062401R4	WM-183 TR-13 (After Rewash)	3AM30	Gamma Scan	Cs-134	1.18E+03	pCi/L	U	9.51E+03	4.76E+03
CP10062501R4	WM-183 TR-53 (After Rewash)	3AM31	Gamma Scan	Cs-134	1.38E+04	pCi/L	U	1.39E+04	6.95E+03
CP10062601R4	WM-183 TR-54 (After Rewash)	3AM32	Gamma Scan	Cs-134	6.97E+03	pCi/L	U	1.10E+04	5.50E+03
CP10060101X3	WM-183 TR-13	3AC55	Gamma Scan	Cs-137	6.20E+08	pCi/L		2.54E+04	1.27E+04
CP10060201X3	WM-183 TR-53	3AC26	Gamma Scan	Cs-137	6.65E+08	pCi/L		3.81E+04	1.91E+04
CP10060301X3	WM-183 TR-54	3AC32	Gamma Scan	Cs-137	6.00E+08	pCi/L		2.60E+04	1.30E+04
CP10060401X3	WM-183 TR-53	3AC38	Gamma Scan	Cs-137	6.37E+08	pCi/L		5.32E+04	2.66E+04
CP10060501X3	WM-183 TR-54	3AC42	Gamma Scan	Cs-137	6.84E+08	pCi/L		4.52E+04	2.26E+04
CP10062201R4	WM-183 TR-53 (After Rewash)	3AM23	Gamma Scan	Cs-137	1.11E+08	pCi/L		1.15E+04	5.75E+03
CP10062301R4	WM-183 TR-54 (After Rewash)	3AM24	Gamma Scan	Cs-137	5.74E+07	pCi/L		9.55E+03	4.78E+03
CP10062401R4	WM-183 TR-13 (After Rewash)	3AM30	Gamma Scan	Cs-137	4.73E+07	pCi/L		8.91E+03	4.46E+03

Table J-1. (continued).

Field Sample ID	Location	Lab Sample ID	Analysis Type	Analyte	Result	Units	Validator Flag[a]	MDA	0.5 × MDA[b]
CP10062501R4	WM-183 TR-53 (After Rewash)	3AM31	Gamma Scan	Cs-137	1.00E+08	pCi/L		1.32E+04	6.60E+03
CP10062601R4	WM-183 TR-54 (After Rewash)	3AM32	Gamma Scan	Cs-137	6.38E+07	pCi/L		1.03E+04	5.15E+03
CP10060101X3	WM-183 TR-13	3AC55	Gamma Scan	Eu-154	1.26E+06	pCi/L		2.86E+04	1.43E+04
CP10060201X3	WM-183 TR-53	3AC26	Gamma Scan	Eu-154	1.90E+06	pCi/L		4.38E+04	2.19E+04
CP10060301X3	WM-183 TR-54	3AC32	Gamma Scan	Eu-154	1.94E+06	pCi/L		3.21E+04	1.61E+04
CP10060401X3	WM-183 TR-53	3AC38	Gamma Scan	Eu-154	1.24E+06	pCi/L		2.90E+04	1.45E+04
CP10060501X3	WM-183 TR-54	3AC42	Gamma Scan	Eu-154	1.52E+06	pCi/L		2.56E+04	1.28E+04
CP10062201R4	WM-183 TR-53 (After Rewash)	3AM23	Gamma Scan	Eu-154	1.29E+04	pCi/L		1.00E+04	5.00E+03
CP10062301R4	WM-183 TR-54 (After Rewash)	3AM24	Gamma Scan	Eu-154	5.80E+03	pCi/L	U	8.21E+03	4.11E+03
CP10062401R4	WM-183 TR-13 (After Rewash)	3AM30	Gamma Scan	Eu-154	5.73E+03	pCi/L	U	7.63E+03	3.82E+03
CP10062501R4	WM-183 TR-53 (After Rewash)	3AM31	Gamma Scan	Eu-154	1.05E+04	pCi/L	U	1.07E+04	5.35E+03
CP10062601R4	WM-183 TR-54 (After Rewash)	3AM32	Gamma Scan	Eu-154	5.83E+03	pCi/L	U	8.24E+03	4.12E+03
CP10060101X3	WM-183 TR-13	3AC55	Gamma Scan	Eu-155	3.80E+05	pCi/L		6.03E+04	3.02E+04
CP10060201X3	WM-183 TR-53	3AC26	Gamma Scan	Eu-155	6.48E+05	pCi/L		9.79E+04	4.90E+04
CP10060301X3	WM-183 TR-54	3AC32	Gamma Scan	Eu-155	1.21E+05	pCi/L	U	1.22E+05	6.10E+04
CP10060401X3	WM-183 TR-53	3AC38	Gamma Scan	Eu-155	4.19E+05	pCi/L		6.60E+04	3.30E+04
CP10060501X3	WM-183 TR-54	3AC42	Gamma Scan	Eu-155	8.86E+04	pCi/L	U	8.95E+04	4.48E+04
CP10062201R4	WM-183 TR-53 (After Rewash)	3AM23	Gamma Scan	Eu-155	3.73E+03	pCi/L	U	3.43E+04	1.72E+04
CP10062301R4	WM-183 TR-54 (After Rewash)	3AM24	Gamma Scan	Eu-155	–2.63E+03	pCi/L	U	2.49E+04	1.25E+04
CP10062401R4	WM-183 TR-13 (After Rewash)	3AM30	Gamma Scan	Eu-155	3.10E+03	pCi/L	U	4.29E+04	2.15E+04
CP10062501R4	WM-183 TR-53 (After Rewash)	3AM31	Gamma Scan	Eu-155	–1.62E+04	pCi/L	U	6.14E+04	3.07E+04

Table J-1. (continued).

Field Sample ID	Location	Lab Sample ID	Analysis Type	Analyte	Result	Units	Validator Flag[a]	MDA	0.5 × MDA[b]
CP10062601R4	WM-183 TR-54 (After Rewash)	3AM32	Gamma Scan	Eu-155	–1.85E+04	pCi/L	U	4.89E+04	2.45E+04
CP10060101X3	WM-183 TR-13	3AC55	Rads	H-3	4.34E+05	pCi/L		3.09E+03	1.55E+03
CP10060201X3	WM-183 TR-53	3AC26	Rads	H-3	6.48E+05	pCi/L		3.07E+03	1.54E+03
CP10060301X3	WM-183 TR-54	3AC32	Rads	H-3	6.71E+05	pCi/L		3.08E+03	1.54E+03
CP10060401X3	WM-183 TR-53	3AC38	Rads	H-3	4.53E+05	pCi/L		3.09E+03	1.55E+03
CP10060501X3	WM-183 TR-54	3AC42	Rads	H-3	4.29E+05	pCi/L		3.09E+03	1.55E+03
CP10060101X5	WM-183 TR-13	01E0-02-A	Rads	I-129	8.40E+02	pCi/L	J	3.30E+02	1.65E+02
CP10060201X5	WM-183 TR-53	01E0-04-A	Rads	I-129	1.48E+03	pCi/L	J	4.67E+01	2.34E+01
CP10060301X5	WM-183 TR-54	01E0-06-A	Rads	I-129	1.62E+03	pCi/L	J	6.60E+01	3.30E+01
CP10060401X5	WM-183 TR-53	01E0-08-A	Rads	I-129	1.15E+03	pCi/L	J	5.11E+01	2.56E+01
CP10060501X5	WM-183 TR-54	01E0-10-A	Rads	I-129	9.96E+02	pCi/L	J	3.62E+01	1.81E+01
CP10060101X3	WM-183 TR-13	3AC55	Gamma Scan	Nb-94	8.22E+03	pCi/L		1.09E+04	5.45E+03
CP10060201X3	WM-183 TR-53	3AC26	Gamma Scan	Nb-94	2.60E+03	pCi/L	U	2.14E+04	1.07E+04
CP10060301X3	WM-183 TR-54	3AC32	Gamma Scan	Nb-94	1.40E+00	pCi/L	U	1.33E+04	6.65E+03
CP10060401X3	WM-183 TR-53	3AC38	Gamma Scan	Nb-94	3.06E+03	pCi/L	U	1.41E+04	7.05E+03
CP10060501X3	WM-183 TR-54	3AC42	Gamma Scan	Nb-94	8.39E+04	pCi/L		1.41E+04	7.05E+03
CP10062201R4	WM-183 TR-53 (After Rewash)	3AM23	Gamma Scan	Nb-94	1.09E+04	pCi/L		4.44E+03	2.22E+03
CP10062301R4	WM-183 TR-54 (After Rewash)	3AM24	Gamma Scan	Nb-94	1.02E+03	pCi/L	U	2.62E+03	1.31E+03
CP10062401R4	WM-183 TR-13 (After Rewash)	3AM30	Gamma Scan	Nb-94	2.53E+02	pCi/L	U	2.83E+03	1.42E+03
CP10062501R4	WM-183 TR-53 (After Rewash)	3AM31	Gamma Scan	Nb-94	1.77E+00	pCi/L	U	4.63E+03	2.32E+03
CP10062601R4	WM-183 TR-54 (After Rewash)	3AM32	Gamma Scan	Nb-94	3.14E+03	pCi/L	U	3.41E+03	1.71E+03
CP10060101X4	WM-183 TR-13	01E0-01-A	Rads	Ni-63	2.25E+05	pCi/L		5.13E+02	2.57E+02
CP10060201X4	WM-183 TR-53	01E0-03-A	Rads	Ni-63	3.29E+05	pCi/L		5.17E+02	2.59E+02
CP10060301X4	WM-183 TR-54	01E0-05-A	Rads	Ni-63	2.84E+05	pCi/L		4.77E+02	2.39E+02
CP10060401X4	WM-183 TR-53	01E0-07-A	Rads	Ni-63	2.12E+05	pCi/L		4.77E+02	2.39E+02
CP10060501X4	WM-183 TR-54	01E0-09-A	Rads	Ni-63	2.20E+05	pCi/L		5.10E+02	2.55E+02

Table J-1. (continued).

Field Sample ID	Location	Lab Sample ID	Analysis Type	Analyte	Result	Units	Validator Flag[a]	MDA	0.5 × MDA[b]
CP10060101X3	WM-183 TR-13	3AC55	Rads	Np-237	2.04E+03	pCi/L		3.55E+02	1.78E+02
CP10060201X3	WM-183 TR-53	3AC26	Rads	Np-237	3.33E+03	pCi/L		3.77E+02	1.89E+02
CP10060301X3	WM-183 TR-54	3AC32	Rads	Np-237	2.89E+03	pCi/L		3.05E+02	1.53E+02
CP10060401X3	WM-183 TR-53	3AC38	Rads	Np-237	1.92E+03	pCi/L		2.30E+02	1.15E+02
CP10060501X3	WM-183 TR-54	3AC42	Rads	Np-237	2.63E+03	pCi/L		1.83E+02	9.15E+01
CP10060101X3	WM-183 TR-13	3AC55	Rads	Pu-238	9.02E+05	pCi/L		7.45E+01	3.73E+01
CP10060201X3	WM-183 TR-53	3AC26	Rads	Pu-238	2.94E+05	pCi/L		8.01E+01	4.01E+01
CP10060301X3	WM-183 TR-54	3AC32	Rads	Pu-238	4.00E+05	pCi/L		4.57E+01	2.29E+01
CP10060401X3	WM-183 TR-53	3AC38	Rads	Pu-238	4.98E+05	pCi/L		4.61E+01	2.31E+01
CP10060501X3	WM-183 TR-54	3AC42	Rads	Pu-238	1.22E+06	pCi/L		5.68E+01	2.84E+01
CP10060101X3	WM-183 TR-13	3AC55	Rads	Pu-239	3.01E+05	pCi/L		6.63E+01	3.32E+01
CP10060201X3	WM-183 TR-53	3AC26	Rads	Pu-239	9.71E+04	pCi/L		6.41E+01	3.21E+01
CP10060301X3	WM-183 TR-54	3AC32	Rads	Pu-239	1.35E+05	pCi/L		4.03E+01	2.02E+01
CP10060401X3	WM-183 TR-53	3AC38	Rads	Pu-239	1.64E+05	pCi/L		3.58E+01	1.79E+01
CP10060501X3	WM-183 TR-54	3AC42	Rads	Pu-239	3.93E+05	pCi/L		4.94E+01	2.47E+01
CP10060101X4	WM-183 TR-13	01E0-01-A	Rads	Pu-241	4.39E+04	pCi/L	J	4.32E+04	2.16E+04
CP10060201X4	WM-183 TR-53	01E0-03-A	Rads	Pu-241	1.28E+05	pCi/L	J	4.32E+04	2.16E+04
CP10060301X4	WM-183 TR-54	01E0-05-A	Rads	Pu-241	1.30E+05	pCi/L	J	4.32E+04	2.16E+04
CP10060401X4	WM-183 TR-53	01E0-07-A	Rads	Pu-241	1.03E+05	pCi/L	J	4.32E+04	2.16E+04
CP10060501X4	WM-183 TR-54	01E0-09-A	Rads	Pu-241	1.02E+05	pCi/L	J	4.32E+04	2.16E+04
CP10060101X3	WM-183 TR-13	3AC55	Gamma Scan	Ra-226	1.28E+01	pCi/L	U	4.68E+05	2.34E+05
CP10060201X3	WM-183 TR-53	3AC26	Gamma Scan	Ra-226	6.82E+05	pCi/L	U	6.89E+05	3.45E+05
CP10060301X3	WM-183 TR-54	3AC32	Gamma Scan	Ra-226	6.92E+05	pCi/L	U	7.94E+05	3.97E+05
CP10060401X3	WM-183 TR-53	3AC38	Gamma Scan	Ra-226	4.67E+05	pCi/L	U	4.72E+05	2.36E+05
CP10060501X3	WM-183 TR-54	3AC42	Gamma Scan	Ra-226	4.95E+05	pCi/L	U	5.95E+05	2.98E+05
CP10062201R4	WM-183 TR-53 (After Rewash)	3AM23	Gamma Scan	Ra-226	2.55E+01	pCi/L	U	2.75E+05	1.38E+05
CP10062301R4	WM-183 TR-54 (After Rewash)	3AM24	Gamma Scan	Ra-226	6.16E+04	pCi/L	U	2.01E+05	1.01E+05
CP10062401R4	WM-183 TR-13 (After Rewash)	3AM30	Gamma Scan	Ra-226	4.62E+06	pCi/L		3.94E+05	1.97E+05

Table J-1. (continued).

Field Sample ID	Location	Lab Sample ID	Analysis Type	Analyte	Result	Units	Validator Flag[a]	MDA	0.5 × MDA[b]
CP10062501R4	WM-183 TR-53 (After Rewash)	3AM31	Gamma Scan	Ra-226	3.05E+05	pCi/L	U	3.66E+05	1.83E+05
CP10062601R4	WM-183 TR-54 (After Rewash)	3AM32	Gamma Scan	Ra-226	5.13E+06	pCi/L		4.27E+05	2.14E+05
CP10060101X3	WM-183 TR-13	3AC55	Gamma Scan	Ru-103	−1.74E+03	pCi/L	U	3.35E+04	1.68E+04
CP10060201X3	WM-183 TR-53	3AC26	Gamma Scan	Ru-103	−5.48E+03	pCi/L	U	4.92E+04	2.46E+04
CP10060301X3	WM-183 TR-54	3AC32	Gamma Scan	Ru-103	6.47E+03	pCi/L	U	3.94E+04	1.97E+04
CP10060401X3	WM-183 TR-53	3AC38	Gamma Scan	Ru-103	7.43E+05	pCi/L	J	4.77E+04	2.39E+04
CP10060501X3	WM-183 TR-54	3AC42	Gamma Scan	Ru-103	−3.58E+03	pCi/L	U	2.97E+04	1.49E+04
CP10062201R4	WM-183 TR-53 (After Rewash)	3AM23	Gamma Scan	Ru-103	1.92E+04	pCi/L	U	1.94E+04	9.70E+03
CP10062301R4	WM-183 TR-54 (After Rewash)	3AM24	Gamma Scan	Ru-103	−2.52E+03	pCi/L	U	1.40E+04	7.00E+03
CP10062401R4	WM-183 TR-13 (After Rewash)	3AM30	Gamma Scan	Ru-103	9.51E+01	pCi/L	U	1.33E+04	6.65E+03
CP10062501R4	WM-183 TR-53 (After Rewash)	3AM31	Gamma Scan	Ru-103	7.92E+02	pCi/L	U	1.94E+04	9.70E+03
CP10062601R4	WM-183 TR-54 (After Rewash)	3AM32	Gamma Scan	Ru-103	−6.03E+03	pCi/L	U	1.54E+04	7.70E+03
CP10060101X3	WM-183 TR-13	3AC55	Gamma Scan	Sb-125	8.75E+05	pCi/L		1.38E+05	6.90E+04
CP10060201X3	WM-183 TR-53	3AC26	Gamma Scan	Sb-125	−5.09E+04	pCi/L	U	1.66E+05	8.30E+04
CP10060301X3	WM-183 TR-54	3AC32	Gamma Scan	Sb-125	3.39E+00	pCi/L	U	1.35E+05	6.75E+04
CP10060401X3	WM-183 TR-53	3AC38	Gamma Scan	Sb-125	2.95E+00	pCi/L	U	1.15E+05	5.75E+04
CP10060501X3	WM-183 TR-54	3AC42	Gamma Scan	Sb-125	2.25E+06	pCi/L		1.22E+05	6.10E+04
CP10062201R4	WM-183 TR-53 (After Rewash)	3AM23	Gamma Scan	Sb-125	3.18E+05	pCi/L		7.61E+04	3.81E+04
CP10062301R4	WM-183 TR-54 (After Rewash)	3AM24	Gamma Scan	Sb-125	4.85E+04	pCi/L	U	4.90E+04	2.45E+04
CP10062401R4	WM-183 TR-13 (After Rewash)	3AM30	Gamma Scan	Sb-125	3.09E+04	pCi/L	U	4.24E+04	2.12E+04
CP10062501R4	WM-183 TR-53 (After Rewash)	3AM31	Gamma Scan	Sb-125	2.07E+05	pCi/L		6.55E+04	3.28E+04

Table J-1. (continued).

Field Sample ID	Location	Lab Sample ID	Analysis Type	Analyte	Result	Units	Validator Flag[a]	MDA	0.5 × MDA[b]
CP10062601R4	WM-183 TR-54 (After Rewash)	3AM32	Gamma Scan	Sb-125	4.90E+04	pCi/L	U	4.95E+04	2.48E+04
CP10060101EA	WM-183 TR-13	3BM35	ICP-MS	Tc-99	5.25E+04	pCi/L	J		
CP10060201EA	WM-183 TR-53	3BM36	ICP-MS	Tc-99	5.81E+04	pCi/L	J		
CP10060301EA	WM-183 TR-54	3BM37	ICP-MS	Tc-99	8.83E+04	pCi/L	J		
CP10060401EA	WM-183 TR-53	3BM38	ICP-MS	Tc-99	8.80E+04	pCi/L	J		
CP10060501EA	WM-183 TR-54	3BM39	ICP-MS	Tc-99	7.63E+04	pCi/L	J		
CP10062201EA[c]	WM-183 TR-53 (After Rewash)	3BM45	ICP-MS	Tc-99	1.76E+03	pCi/L	J		
CP10062401EA[c]	WM-183 TR-13 (After Rewash)	3BM46	ICP-MS	Tc-99	4.99E+02	pCi/L	J		
CP10062501EA[c]	WM-183 TR-53 (After Rewash)	3BM47	ICP-MS	Tc-99	1.32E+03	pCi/L	J		
CP10062601EA[c]	WM-183 TR-54 (After Rewash)	3BM48	ICP-MS	Tc-99	8.04E+02	pCi/L	J		
CP10060101X4	WM-183 TR-13	01E0-01-A	Rads	Total-Sr	5.03E+08	pCi/L	J	8.03E+06	4.02E+06
CP10060201X4	WM-183 TR-53	01E0-03-A	Rads	Total-Sr	7.28E+08	pCi/L		5.11E+06	2.56E+06
CP10060301X4	WM-183 TR-54	01E0-05-A	Rads	Total-Sr	9.49E+08	pCi/L		5.49E+06	2.75E+06
CP10060401X4	WM-183 TR-53	01E0-07-A	Rads	Total-Sr	7.64E+08	pCi/L		5.65E+06	2.83E+06
CP10060501X4	WM-183 TR-54	01E0-09-A	Rads	Total Sr	5.26E+08	pCi/L		7.03E+06	3.52E+06
CP10060101X3	WM-183 TR-13 (After Rewash)	3AC55	Rads	U-234	1.02E+03	pCi/L		5.24E+01	2.62E+01
CP10060201X3	WM-183 TR-53	3AC26	Rads	U-234	1.82E+03	pCi/L		4.99E+01	2.50E+01
CP10060301X3	WM-183 TR-54	3AC32	Rads	U-234	1.44E+03	pCi/L		2.64E+01	1.32E+01
CP10060401X3	WM-183 TR-53	3AC38	Rads	U-234	1.30E+03	pCi/L		7.48E+01	3.74E+01
CP10060501X3	WM-183 TR-54	3AC42	Rads	U-234	1.04E+03	pCi/L		7.50E+01	3.75E+01
CP10060101X3	WM-183 TR-13	3AC55	Rads	U-235	1.25E+02	pCi/L	J	3.55E+01	1.78E+01
CP10060201X3	WM-183 TR-53	3AC26	Rads	U-235	8.90E+01	pCi/L	J	3.44E+01	1.72E+01
CP10060301X3	WM-183 TR-54	3AC32	Rads	U-235	4.33E+01	pCi/L	J	2.60E+01	1.30E+01
CP10060401X3	WM-183 TR-53	3AC38	Rads	U-235	6.40E+01	pCi/L	J	5.10E+01	2.55E+01
CP10060501X3	WM-183 TR-54	3AC42	Rads	U-235	2.17E+01	pCi/L	U	5.84E+01	2.92E+01

Table J-1. (continued).

Field Sample ID	Location	Lab Sample ID	Analysis Type	Analyte	Result	Units	Validator Flag[a]	MDA	0.5 × MDA[b]
CP10060101X3	WM-183 TR-13	3AC55	Rads	U-238	1.27E+01	pCi/L	U	3.12E+01	1.56E+01
CP10060201X3	WM-183 TR-53	3AC26	Rads	U-238	7.40E+01	pCi/L	J	2.87E+01	1.44E+01
CP10060301X3	WM-183 TR-54	3AC32	Rads	U-238	5.23E+01	pCi/L	J	2.06E+01	1.03E+01
CP10060401X3	WM-183 TR-53	3AC38	Rads	U-238	6.99E+01	pCi/L	J	2.71E+01	1.36E+01
CP10060501X3	WM-183 TR-54	3AC42	Rads	U-238	8.74E+01	pCi/L	U	3.79E+01	1.90E+01
CP10060101X3	WM-183 TR-13	3AC55	Gamma Scan	Zr-95	8.67E+04	pCi/L		2.69E+04	1.35E+04
CP10060201X3	WM-183 TR-53	3AC26	Gamma Scan	Zr-95	1.00E+05	pCi/L		3.98E+04	1.99E+04
CP10060301X3	WM-183 TR-54	3AC32	Gamma Scan	Zr-95	9.75E+04	pCi/L		2.29E+04	1.15E+04
CP10060401X3	WM-183 TR-53	3AC38	Gamma Scan	Zr-95	8.90E+04	pCi/L		2.70E+04	1.35E+04
CP10060501X3	WM-183 TR-54	3AC42	Gamma Scan	Zr-95	9.40E+04	pCi/L		1.97E+04	9.85E+03
CP10062201R4	WM-183 TR-53 (After Rewash)	3AM23	Gamma Scan	Zr-95	–3.13E+02	pCi/L	U	6.29E+03	3.15E+03
CP10062301R4	WM-183 TR-54 (After Rewash)	3AM24	Gamma Scan	Zr-95	2.00E+02	pCi/L	U	4.27E+03	2.14E+03
CP10062401R4	WM-183 TR-13 (After Rewash)	3AM30	Gamma Scan	Zr-95	5.83E+02	pCi/L	U	4.76E+03	2.38E+03
CP10062501R4	WM-183 TR-53 (After Rewash)	3AM31	Gamma Scan	Zr-95	2.52E+03	pCi/L	U	7.64E+03	3.82E+03
CP10062601R4	WM-183 TR-54 (After Rewash)	3AM32	Gamma Scan	Zr-95	2.61E+02	pCi/L	U	5.56E+03	2.78E+03

a. Validator flags:
J = Estimated value.
U = Analyte was analyzed for but not detected. Analyte result was below the contract required quantitation limit.

b. Used when result reported is not statistically positive.

c. Only four samples were analyzed for Tc-99.